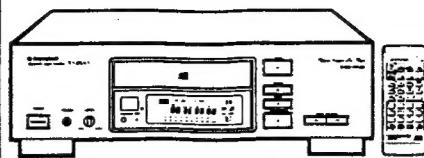


# Service Manual


 ORDER NO.  
**ARP2062**

COMPACT DISC PLAYER

# **PD-8500**

**PD-8500 HAS FOLLOWING VERSIONS :**

Type	Power requirement	Export destination
KU/CA	AC 120V only	U.S.A and Canada
HEM	AC 220V, 240V (switchable) *	European continent
HB	AC 220V, 240V (switchable) *	United kingdom
HPW	AC 220V, 240V (switchable) *	Australia
SD	AC 110V, 120V-127V, 220V, 240V (switchable)	Kingdom of Saudi Arabia and General market

\* Change the primary wiring of the transformer board assembly.

- This manual is applicable to the KU/CA, HEM, HB, HPW and SD types.
- As to the HEM, HB, HPW and SD types, refer to pages 66.
- As to the circuit descriptions, refer to the PD-8500 service guide (ARP2090)
- Ce manuel pour le service comprend les explications de réglage en français.
- Este manual de servicio trata del método ajuste escrito en español.

## CONTENTS

1. SAFETY INFORMATION	2	8. IC INFORMATION	63
2. EXPLODED VIEWS AND PARTS LIST	4	9. BLOCK DIAGRAM	64
3. PACKING	10	10. FOR HEM, HB, HPW AND SD TYPES	66
4. SCHEMATIC DIAGRAM	15	11. SPECIFICATIONS	70
5. P.C. BOARDS CONNECTION DIAGRAM	19	12. PANEL FACILITIES	71
6. P.C. B's PARTS LIST	27		
7. ADJUSTMENTS	30		
RÉGLAGES	41		
AJUSTES	52		

**PIONEER ELECTRONIC CORPORATION** 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153. Japan

**PIONEER ELECTRONICS SERVICE INC.** P.O. Box 1760, Long Beach, California 90801 U.S.A.

**PIONEER ELECTRONICS OF CANADA, INC.** 505 Cochrane Drive, Markham, Ontario L3R 8E3 Canada

**PIONEER ELECTRONIC [EUROPE] N.V.** Keetberglaan 1, 2740 Beveren, Belgium

**PIONEER ELECTRONICS AUSTRALIA PTY. LTD.** 178-184 Boundary Road, Braeside, Victoria 3195, Australia TEL: [03] 580-9911

© PIONEER ELECTRONIC CORPORATION 1990

This service manual is intended for qualified service technicians; it is not meant for the casual do-it-yourselfer. Qualified technicians have the necessary test equipment and tools, and have been trained to properly and safely repair complex products such as those covered by this manual.

Improperly performed repairs can adversely affect the safety and reliability of the product and may void the warranty. If you are not qualified to perform the repair of this product properly and safely, you should not risk trying to do so and refer the repair to a qualified service technician.

#### WARNING

Lead in solder used in this product is listed by the California Health and Welfare agency as a known reproductive toxicant which may cause birth defects or other reproductive harm (California Health & Safety Code, Section 25249.5).

When servicing or handling circuit boards and other components which contain lead in solder, avoid unprotected skin contact with the solder. Also, when soldering do not inhale any smoke or fumes produced.

## 1. SAFETY INFORMATION

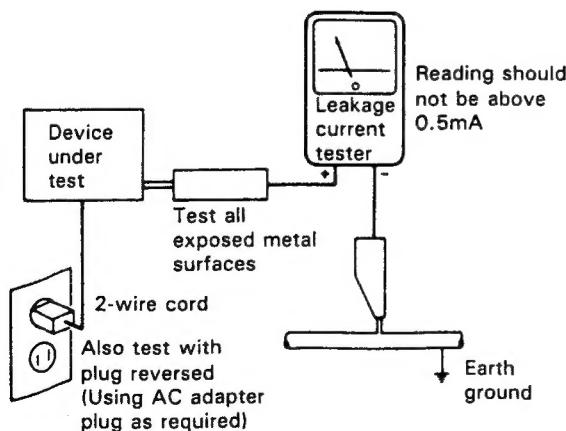
(FOR USA MODEL ONLY)

### 1. SAFETY PRECAUTIONS

The following check should be performed for the continued protection of the customer and service technician.

#### LEAKAGE CURRENT CHECK

Measure leakage current to a known earth ground (water pipe, conduit, etc.) by connecting a leakage current tester such as Simpson Model 229-2 or equivalent between the earth ground and all exposed metal parts of the appliance (input/output terminals, screwheads, metal overlays, control shaft, etc.). Plug the AC line cord of the appliance directly into a 120V AC 60Hz outlet and turn the AC power switch on. Any current measured must not exceed 0.5mA.



AC Leakage Test

ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE ARE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND MUST BE CORRECTED BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

### 2. PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in the appliance have special safety related characteristics. These are often not evident from visual inspection nor the protection afforded by them necessarily can be obtained by using replacement components rated for voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Service Manual.

Electrical components having such features are identified by marking with a  $\Delta$  on the schematics and on the parts list in this Service Manual. The use of a substitute replacement component which does not have the same safety characteristics as the PIONEER recommended replacement one, shown in the parts list in this Service Manual, may create shock, fire, or other hazards.

Product Safety is continuously under review and new instructions are issued from time to time. For the latest information, always consult the current PIONEER Service Manual. A subscription to, or additional copies of, PIONEER Service Manual may be obtained at a nominal charge from PIONEER.

## (FOR EUROPEAN MODEL ONLY)

## VARO!

AVATTAESSA JA SUOJALUKITUS  
OHITETTAESSA OLET ALTIINA  
NÄKYMÄTTÖMÄLLE LASERSÄTEILYLLÉ.  
ÄLÄ KATSO SÄTEESEEN.



LASER  
Kuva 1  
Lasersateilyn  
varoitusmerkki

## ADVERSEL:

USYNLIG LASERSTRÅLING VED ÅBNING  
NÄR SIKKERHEDSAFBRYDERE ER UDE AF  
FUNKTION UNDGÅ UDSAETTELSE FOR  
STRÅLING.

## WARNING!

OSYNLIG LASERSTRÄLNING NÄR DENNA  
DEL ÄR ÖPPNAD OCH SPÄRREN  
ÄR URKOPPLAD. BETRAKTA EJ STRÄLEN.

## WARNING!

DEVICE INCLUDES LASER DIODE WHICH  
EMITS INVISIBLE INFRARED RADIATION  
WHICH IS DANGEROUS TO EYES. THERE IS  
A WARNING SIGN ACCORDING TO PICTURE  
1 INSIDE THE DEVICE CLOSE TO THE LASER  
DIODE.



LASER  
Picture 1  
Warning sign for  
laser radiation

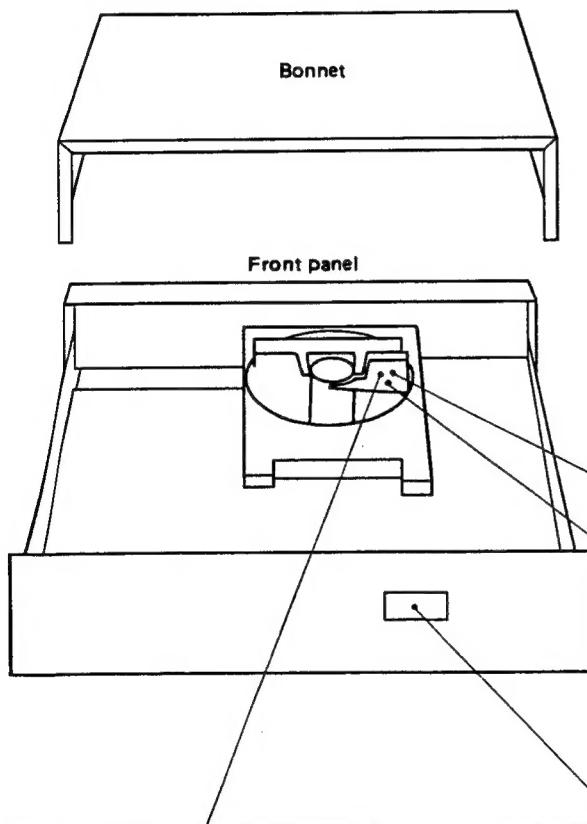
## IMPORTANT

THIS PIONEER APPARATUS CONTAINS  
LASER OF HIGHER CLASS THAN 1.  
SERVICING OPERATION OF THE APPARATUS  
SHOULD BE DONE BY A SPECIALLY  
INSTRUCTED PERSON.

## LASER DIODE CHARACTERISTICS

MAXIMUM OUTPUT POWER: 5 mw  
WAVELENGTH: 780-785 nm

## LABEL CHECK (SINGLE type)



**CAUTION**  
INVISIBLE LASER  
RADIATION WHEN OPEN,  
AVOID EXPOSURE  
TO BEAM

PRW1018

HB type

**CLASS 1**  
LASER PRODUCT

VRW-328

HEM and HB types



HEM and HB types

**ADVARSEL**  
USYNLIG LASERSTRÅLING VED ÅBNING NÄR SIKKERHEDSAFBRYDERE ER UDE AF FUNKTION.  
UNDGÅ UDSAETTELSE FOR STRÅLING.  
**VORSICHT!**  
UNSICHTBARE LASER-STRÄHLUNG TRITT AUS, WENN DECKEL  
(ODER KLAPE) GEÖFFNET IST! NICHT DEM STRAHL AUSSETZEN!  
VRW1094

HEM type

## 2. EXPLODED VIEWS AND PARTS LIST

## NOTES :

- Parts without part number cannot be supplied.
- The  $\Delta$  mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- Parts marked by "●" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.

### 2.1 EXTERIOR

#### Parts List

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
$\Delta$	1	CM-22C	Strain relief		101		Lead wire unit
$\Delta$	2	PDG1002	AC power cord		102		Shield cover
$\Delta$	3	PTT1109	Power transformer (AC120V)		103		Spacer
	4	ABE1009	Washer		104		Under base
					105		Rear base
	5	PBA1027	Floating screw		106		Side angle
	6	PNM1008	Cushion		107		Mechanism plate
	7	PNM1095	Stopper		108		Mechanism base
	8	PNM1099	Tape		109		Base
	9	PNW1761	Slide guide		110		Clamp
	10	RNH-184	Cord holder		111		PCB spacer
	11	PBH1013	Spring		112		P plate holder
	12	PBP-001	Steel ball $\phi 4$		113		Loading base assembly
	13	PEB1032	Stopper rubber		114		Tray assembly
	14	PNW1084	Clamp holder		115		Servo mechanism assembly
	15	PNW1085	Clamp retainer		116		Name plate
	16	PEB1031	Floating rubber		117		Front panel
	17	PNM1010	Disc cushion		118		Function panel
	18	PAA1007	Gold button		119		Headphone board assembly
	19	PAC1498	Power knob		120		Transformer board assembly
	20	PAD1056	Play button assembly		121		Primary board assembly
	21	PNW1258	Play lens		122		Cushion
	22	PAM1323	Display screen		123		Cushion
	23	PAM1444	Display window				
	24	PBK1079	Earth plate				
	25	PNW1762	Tray name plate				
	26	RAC1414	Knob B				
	27	BBT30P080FCU	Screw				
	28	BBZ30P060FCC	Screw				
	29	BBZ30P080FCC	Screw				
	30	BBZ30P140FCC	Screw				
	31	BBZ40P080FZK	Screw				
	32	BPZ30P250FMC	Screw				
	33	FBT40P080FZK	Screw				
	34	IBZ30P060FCC	Screw				
	35	IBZ30P080FCC	Screw				
	36	IBZ30P100FCC	Screw				
	37	IBZ30P150FCU	Screw				
	38	PMZ30P060FCU	Screw				
	39	PPZ30P150FMC	Screw				
	40	WA32F070M080	Washer				
	41	PEA1087	Front panel assembly				
	42	PYY1071	Bonnet				
●	43	PWZ1751	Main board assembly				
●	44	PWZ1936	Audio board assembly				
●	45	PWX1133	Sub board assembly				
	46	PNM1107	Stopper				



# Service Manual

SERVICE GUIDE

ORDER NO.

ARP2090

COMPACT DISC PLAYER

**PD-8500**

- Refer to the service manual ARP2062, PD-8500/KU/CA, HEM, HB, HPW and SD types.
- This manual is applicable to the PD-8500/KU/CA, HEM, HB, HPW and SD types.

---

**PIONEER ELECTRONIC CORPORATION**

4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan

**PIONEER ELECTRONICS SERVICE INC.** P.O. Box 1760, Long Beach, California 90801 U.S.A.

**PIONEER ELECTRONICS OF CANADA, INC.** 505 Cochrane Drive, Markham, Ontario L3R 8E3 Canada

**PIONEER ELECTRONIC [EUROPE] N.V.** Keetberglaan 1, 2740 Beveren, Belgium

**PIONEER ELECTRONICS AUSTRALIA PTY. LTD.** 178-184 Boundary Road, Braeside, Victoria 3195, Australia TEL: [03] 580-9911

**© PIONEER ELECTRONIC CORPORATION 1990**

IFI JULY 1990 Printed in Japan

# 1. CIRCUIT DESCRIPTION

## 1.1 Preamplifier

In the preamplifier block, analog processing of pickup signals is executed to make signals so send to a servo block and a decoder block.

The main part of this circuit is IC101:TA8137N. Each part is explained below.

Fig. 1-1 shows a block diagram of the internal configuration of the TA8137N.

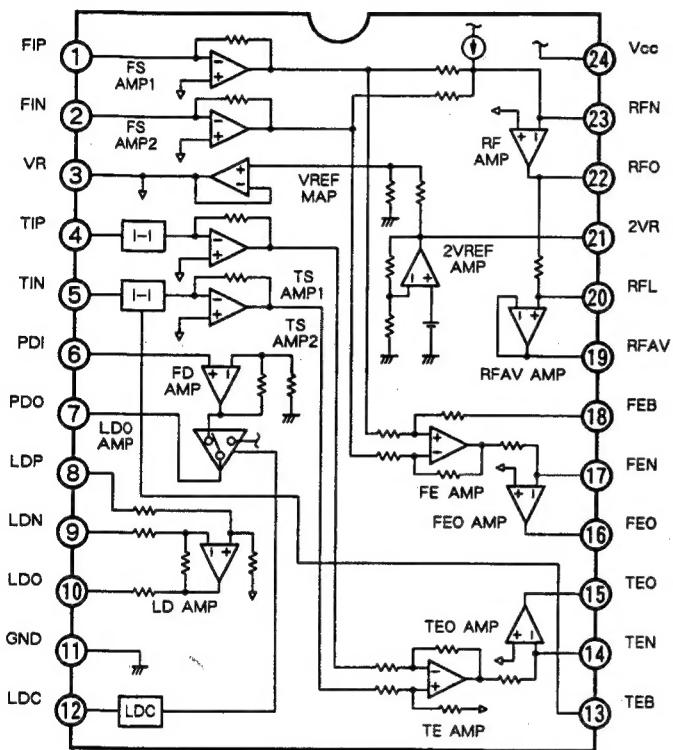


Fig. 1-1 Block diagram of TA8137N

## 1. Accurate focus system

To reduce distortion of an RF signal which is read with a pickup, the output signals of the preceding two photodiodes among fourdivision photodiodes are delayed and added. Then frequency response, distortion, signal-to-noise ratio, etc. are improved, and high-accuracy signal reading is obtained. (See Fig. 1-2)

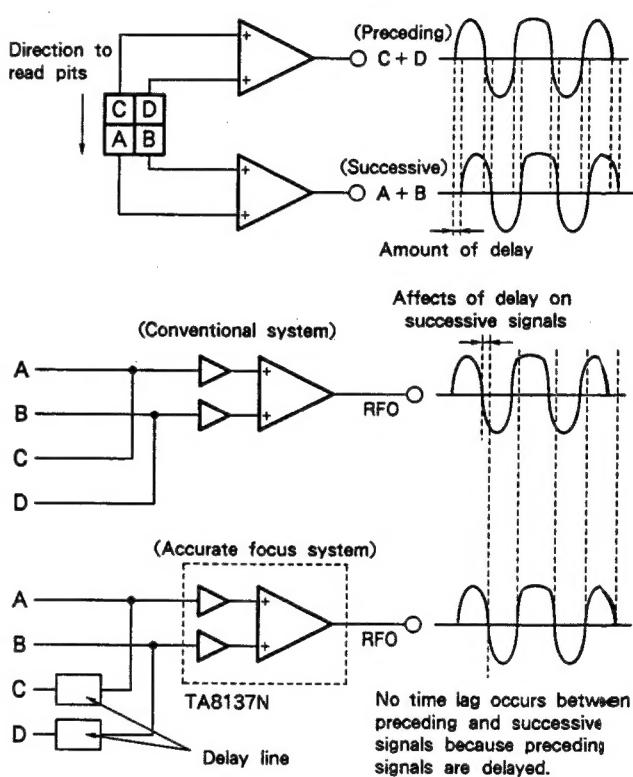


Fig. 1-2

## 2. RF amplifier

The digital servo LSI used in the PD-8500 is driven with a single 5 V power source. As a pickup, a new OEIC is used and is driven with a single 5 V power source, because of RF amplifier is driven with a single 5V power source. So the output voltage from the pickup is supplied based on the reference voltage of 2 V of the LSI system.

In a conventional system, the output voltage of a photodiode is that dozens to several hundred mV are added to GND, while that of this system is that dozens to several hundred mV are added to the 2 V.

The OEIC output voltages supplied to the input terminals (FIP, FIN) are amplified in RF I-V amplifiers (1) and (2), and are added in an RF summing amplifier. The added and amplified OEIC output voltage (A + B + C + D) is output from the RFO terminal. The eye pattern is checked at this terminal.

The current source "i" which is input to the RF summing amplifier and an externally attached R18 lower the central voltage of the RF at the RFO terminal below the reference voltage (VR).

Adjust the RFO level using VR1 for the LD power adjustment so that the level is usually 1.5Vp-p.

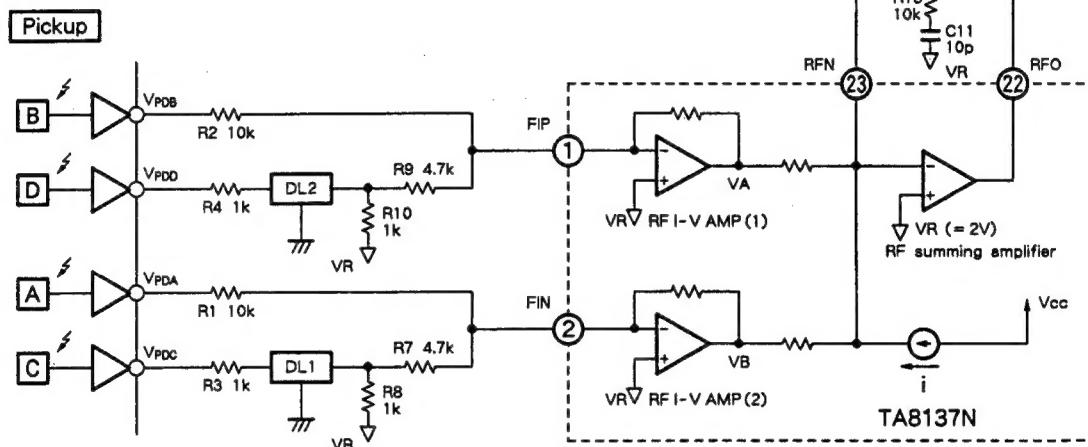


Fig. 1-3

## 3. RF AV amplifier

The LPF output of an RF signal is an RFAV signal, which is input to servo IC TC9220F-002. The RFAV signal is converted to a digital signal in the servo IC, then changed to the following signals :

- ① Focus OK signal
- ② Signal which decides the on-track status during search

RFAV is an abbreviation for average RF signal.

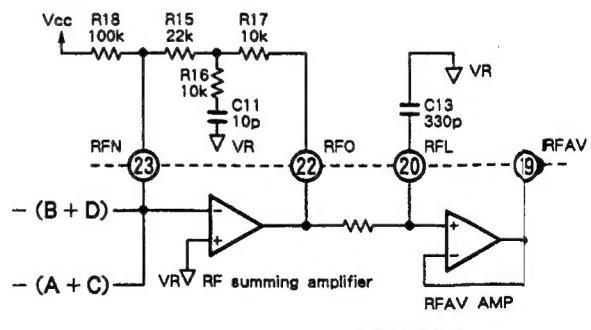


Fig. 1-4

#### 4. Focus error amplifier

The difference between the output of the RF I-V amplifier (1)  $V_A$  and that of the RF I-V amplifier (2)  $V_B$  is obtained, and the OEIC output signal  $(B + D) - (A + C)$  is supplied at the center of the reference voltage. (See Fig. 1-5.)

The offset and gain are automatically adjusted (for details, see "Servo IC") so a semi-fixed resistor for adjustment which is essential in a conventional system is not provided.

An externally attached  $C_{15}$ , which functions as an equalizer in a conventional system, functions as an LPF for an input signal of an A/D converter because an FE signal is input to the A/D converter after input to the servo IC.

This signal is also used to decide whether focus-in is OK or not when the focus gain is automatically adjusted. The S-character level at the FEO terminal is usually set to 1.5 to 2.0 Vp-p.

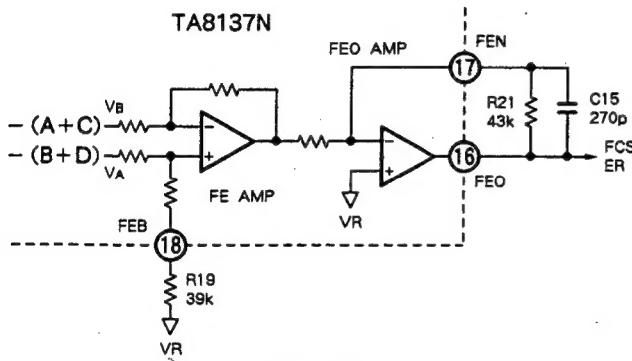


Fig. 1-5

#### 5. Tracking error amplifier

The OEIC output voltages of a side spot which are input to the TIP and TIN terminals are converted to the current at input resistors R5 and R6, and the polarity is reversed in I-I conversion blocks. (See Fig. 1-6.)

The control voltage is input to the I-I conversion blocks from the servo IC through TEB (pin 13) with which the tracking error balance is automatically adjusted in the same way as the focus gain adjustments.

The control signal for balance adjustment is adjusted to the optimum level with R28 and R29.

After the I-I conversion, the signal is amplified in the TS, TE and TEO amplifiers, and is output from the TEO terminal at the center of the reference voltage. The TRK ER level with the tracking servo set to OPEN is usually set to 1.5 to 2.0 Vp-p.

As the offset and gain are automatically adjusted (including the tracking error balance adjustment) in the same way as focus adjustment, the TROF, TRGA and TRBL semifixed resistors are not provided.

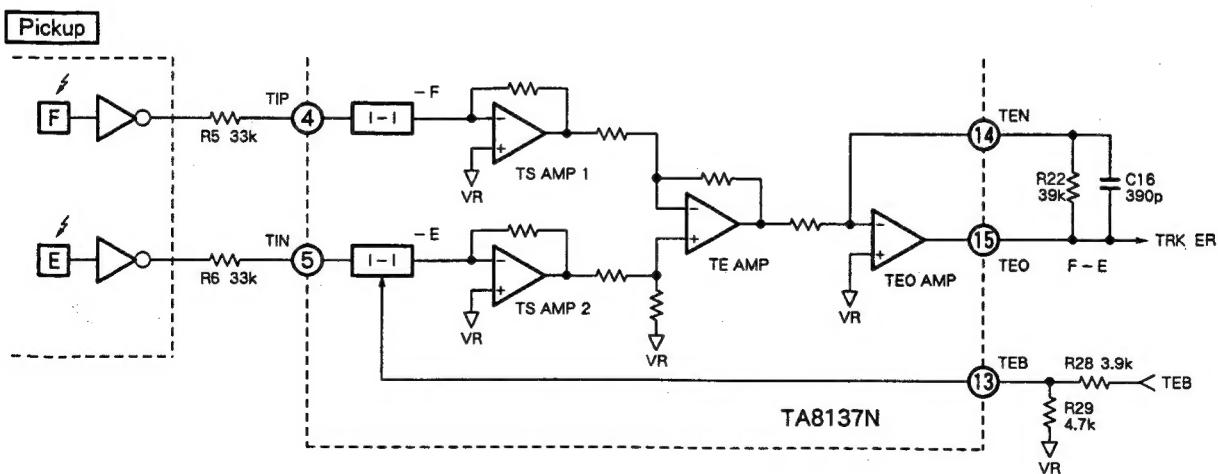


Fig. 1-6

## 6. APC (Automatic Power Control) circuit

As photo-output has great negative temperature characteristics when a laser diode is driven with a constant current, the current should be controlled so that constant output is obtained at the monitor photo diode. This is the purpose of an APC circuit.

The APC circuit of the RF amplifier IC used in PD-8500 is different from the conventional CXA1081S. So when a pickup assembly which is adjusted with CXA1081S is connected (for example when the servo mechanism is changed, etc.), the LD power may exceed the rated value (130 mW). In this case, the RF<sub>p-p</sub> level should be readjusted with VR1 for the LD power adjustment.

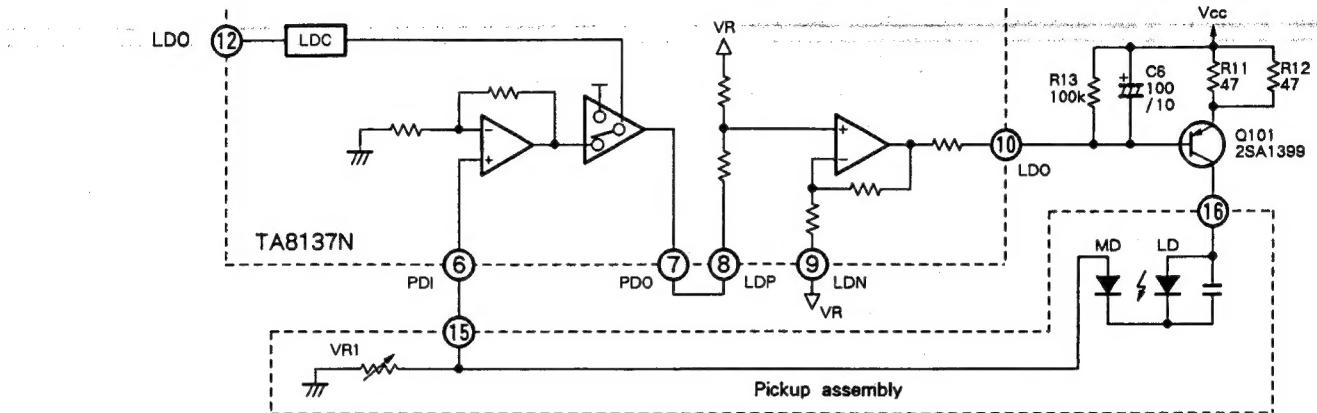


Fig. 1-7

## 7. Peripheral circuit

### (a) Tracking error system

The TRK ER signal is converted from analog to digital after it is input to servo IC TC9220F-002. In the servo IC, the flaw component of a tracking error signal is detected, and the gain of the tracking servo is raised. (During flaw detection, the level of the GUP terminal, pin 38 of the servo IC, is set to "H"). With this flag signal, Q5 is set to OFF during flaw detection. During normal playback, Q5 is set to ON, and the high frequency range of the TRK ER signal is cut.

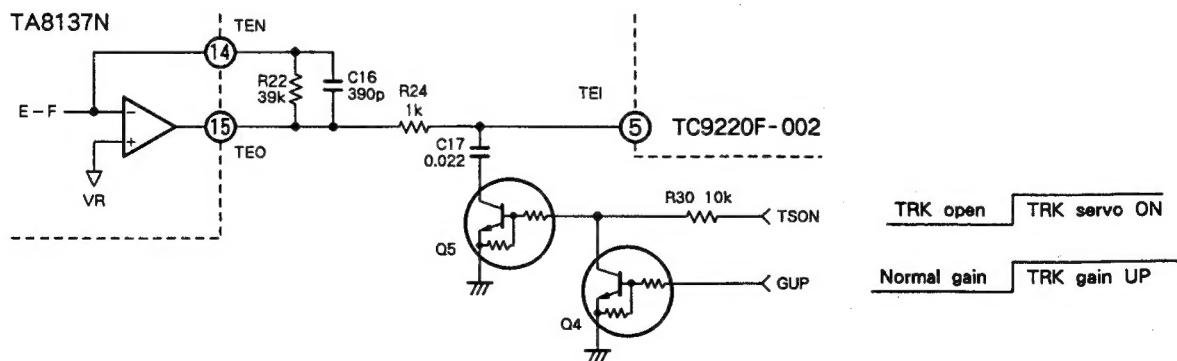


Fig. 1-8

**(b) RFAV system**

An RFAV signal is obtained by cutting the high-frequency range of an RF signal so that it is about the median value of the RF signal. When surface of a disc is dirty, the amount of light will be reduced at the dirty part which causes depression of the RF signal. This causes depression of the RFAV signal. (See Fig. 1-9.)

In this system, a hysteresis operation is done to brake the jump. During this hysteresis operation, the DC level difference caused by the depression is depressed, which improves convergence after the jump.

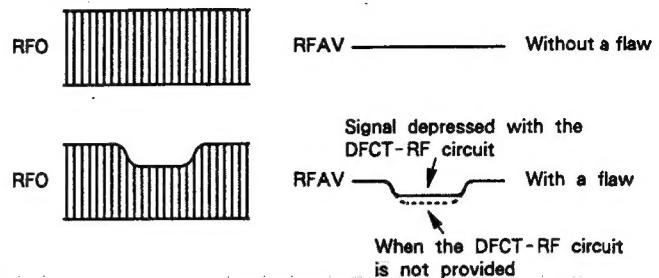


Fig. 1-9

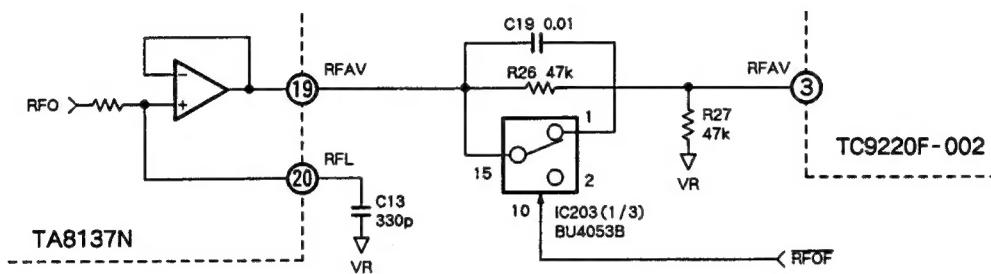


Fig. 1-10

**8. Reference power-source circuit**

This system operates with a single 5 V power source so a reference voltage which is equivalent to 0 V, the median voltage of  $\pm 5$  V in a conventional system, is required. The reference voltage VR is 2 V, and is generated in an RF amplifier and supplied to servo IC TC9220F-002, DSP TC9221F, etc.

As a single 5 V operation, the upper-limit voltage 5 V is not used. The negative side against 2 V is from 0 to 2 V and the positive side is from 2 to 4 V. The upper limit value 2VR (= 4V) is also generated in this IC and supplied to each IC.

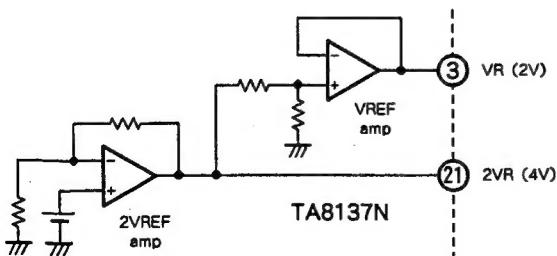


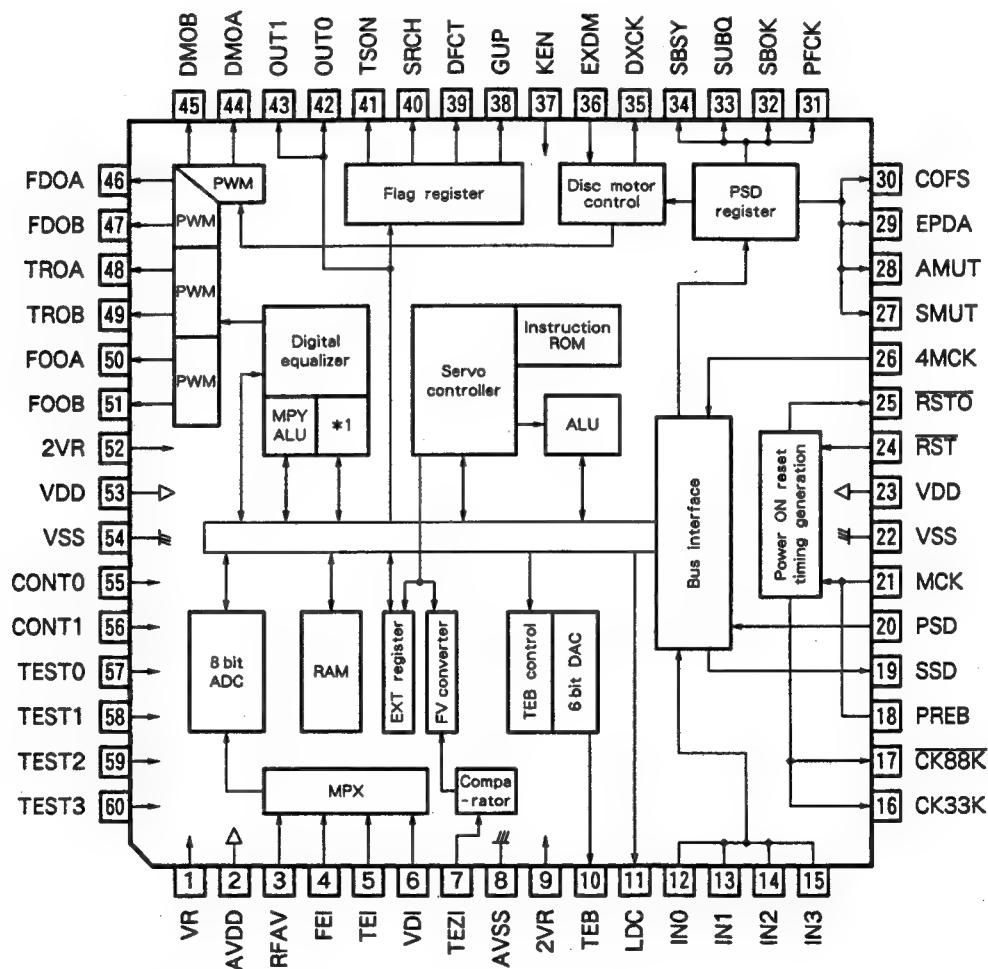
Fig. 1-11

## 1.2 Servo Block

In a servo block, ordinary servo operations such as focus servo, tracking servo, carriage servo and spindle servo, and also special servo operations such as focus-in, track jump, etc. are controlled with the system controller through the DSP.

In this system, this block also adjusts focus offset, tracking offset, focus gain, tracking gain and tracking balance automatically.

The main part of this block is IC100: TC9220F-002 (abbreviated to TC9220F), and each part is explained below.



\*1 : Coefficient control ROM.

Fig. 1-12 Block diagram of TC9220F-002

## 1. Offset automatic adjustment (FTOA) system

In a conventional system, an operating point may shift because of an offset in the preamplifier, etc., and adjustment using a semi-fixed resistor is necessary. In this system, this adjustment is automatically executed in a servo IC with digital processing of the offset component.

The offset adjustment system extracts the DC offset of a focus error signal and tracking error signal, and stores the level of an RFAV signal with the focus servo off. This operation is executed with the offset adjustment command sent from the microcomputer rest after the power turned on or when reset is released. When the servo IC accepts this command, it reads the focus error level and tracking error level from the A/D converter with the LD set to off, and stores the value as the median value of the error. Using this value, the DC offset of a focus error signal or a tracking error signal which is internally processed, is completely compensated.

In normal playback, offset is always adjusted automatically for compensation of temperature change. When adjusting offset after reset, the RFAV signal level is also stored as the reference level to decide whether focus-in is OK or not, and an FOK signal is generated.

## 2. Focus servo system

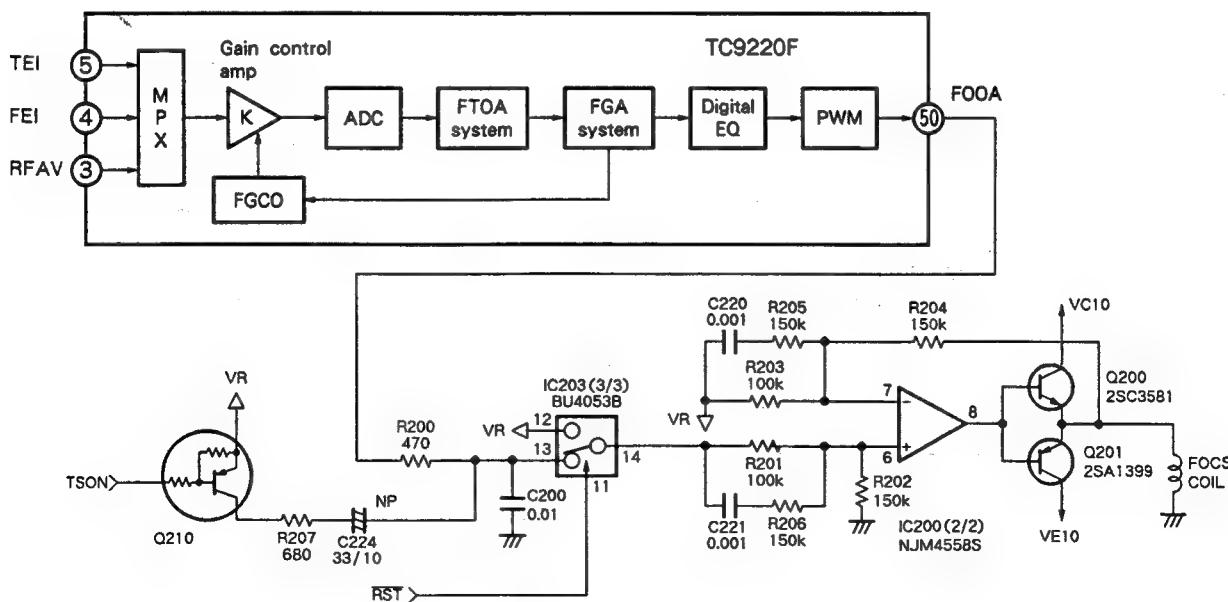


Fig. 1-14

**(a) Focus gain automatic adjustment (FGA) system**

The focus gain automatic adjustment system adjusts the DC gain of the focus servo loop. When the microcomputer sends a gain adjustment command, the output at the FOOA terminal brings the lens down to the LLM level, then it raises the lens with the internally set time constant. When the lens comes near the in-focus point, an S-character is generated in the FEO signal, with which an error can be detected. After a specific amount of time has passed, the polarity of the output at the FOOA terminal is reversed. The up-and-down operation of the lens is repeated for a specified number of times as shown in the timing chart (Fig. 1-15.)

The IC automatically sets the gain with the focus gain control (FGCO) by digital conversion of S-character error data. When gain adjustment completes, the focus-in operation follows.

During this adjustment, the disc rotates a little to average the S-character before the gain adjustment. Focus gain adjustment is necessary with each focus-in operation. So when a disc is changed and the reflection ratio of the disc is different, gain adjustment is necessary for each disc.

The analog switch (IC203 (3/3)) in Fig. 1-14 functions as a muting circuit to prevent the lens from attaching to a disc when the power is turned on.

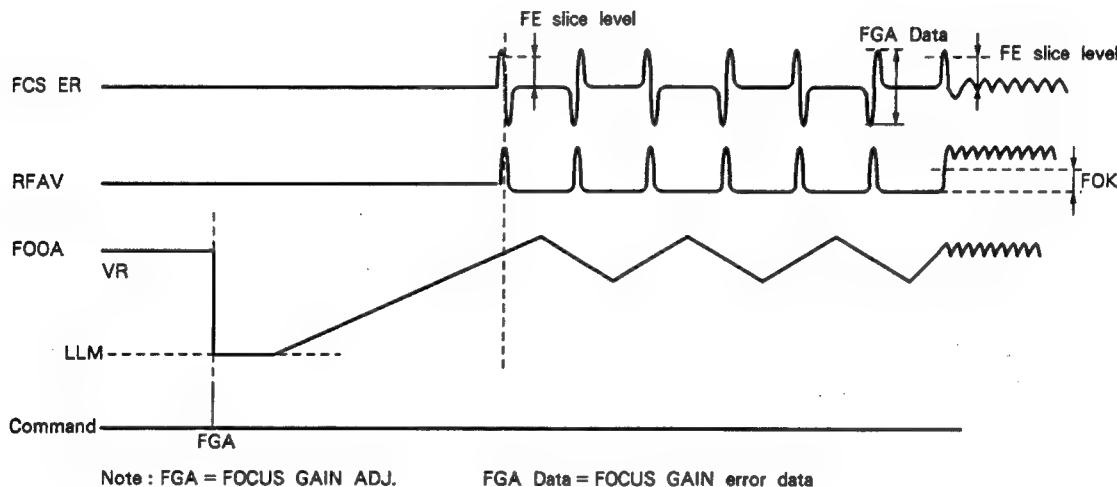


Fig. 1-15

**Note :**

As FOOA (IC100 : TC9220F, pin 50) is a PWM output, it is shown with an average DC voltage in Fig. 1-15.

Actually compression waves of pulses with "L" of 0 to VR and "H" of VR to 2VR are observed. (Fig. 1-16)

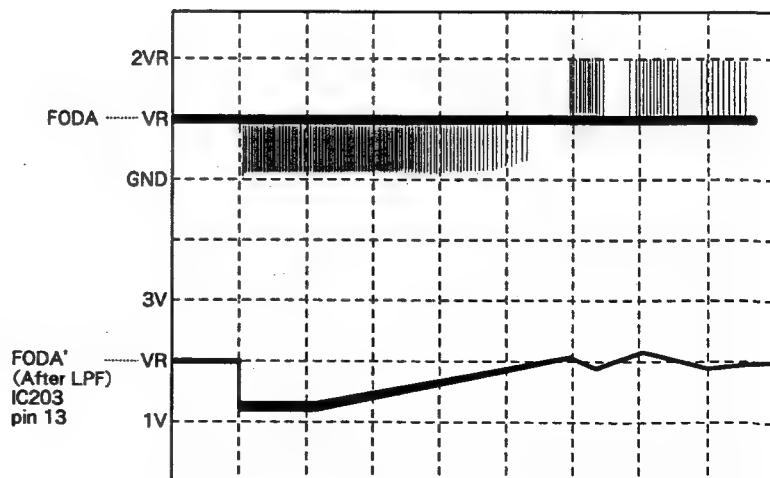


Fig. 1-16

## (b) Focus search system

When the focus gain automatic adjustment is finished, IC100 : TC92220F automatically starts the focus search operation.

After automatic adjustment, the lens descends, then rises. When it rises past the in-focus point and a focus error signal also exceeds the set slice level, the focus servo goes to standby mode, and the focus servo on operation is done at zero-cross of an FEO signal. After the focus-in operation, the difference between the RFAV signal and the value of RFAV in STOP mode stored with the FTOA command is checked, and it is decided whether the focus search operation has been performed successfully or not (FOK).

When the disc is not set, the focus gain automatic adjustment operation (up and down operation of the lens) is repeated three times (UP 3, DOWN 3), then it is tried again and the system returns to STOP mode.

## 3. Tracking servo system

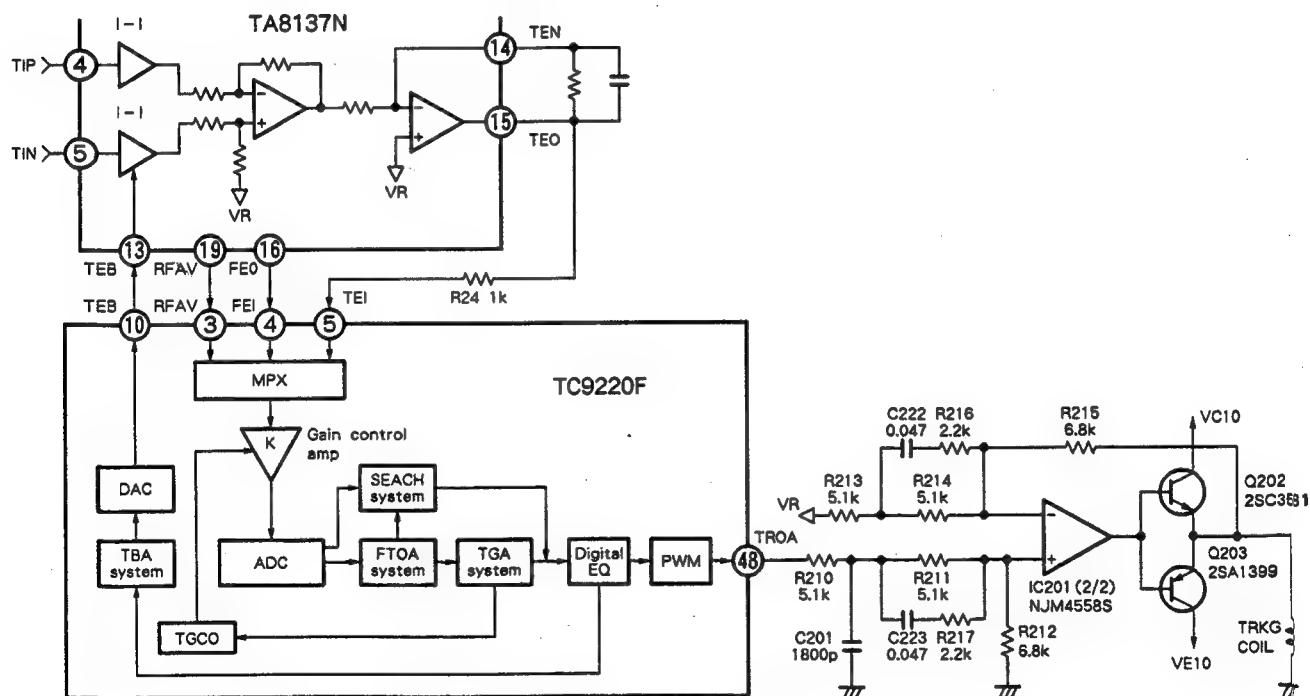


Fig. 1-17

(a) Tracking gain automatic adjustment (TGA) system

The tracking gain automatic adjustment system adjusts the DC gain of a tracking servo loop. After adjusting the focus gain, the gain adjustment command is sent from the microcomputer, then a tracking actuator drive signal is output from the TROA terminal. When the system reads tracking error data across the set track, the lens drive signal which is output from the TROA terminal is reversed.

This operation is repeated the specified number of times. Values for wave height for five data of a tracking error signal are read and are converted to digital data. Then the IC automatically adjusts the gain setting with tracking gain control (TGCO). Tracking gain adjustment is performed every time the tray is opened and closed. So each time a disc is changed, this adjustment is performed, which means that the optimum gain can be set for each disc.

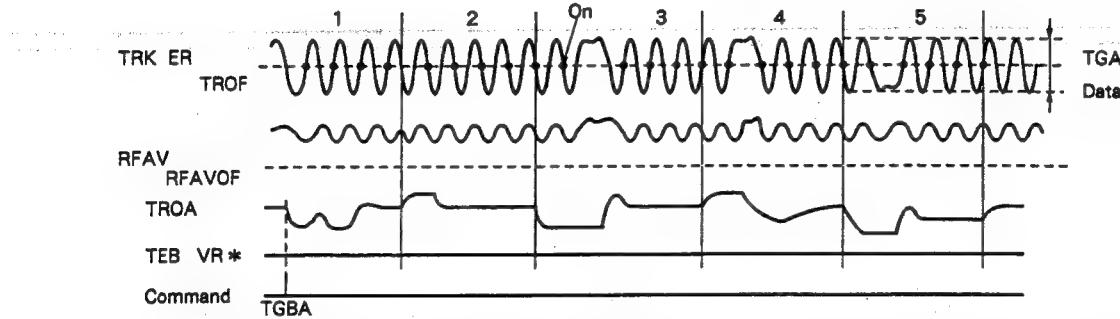


Fig. 1-18

**(b) Tracking balance adjustment (TBA) system**

When the tracking gain adjustment is finished, the IC automatically executes tracking balance adjustment. Gain and balance adjustments are executed with a single command from the microcomputer. So a new command is not be sent.

A lens drive signal which is output from the TROA terminal is reversed for each set track in the same process as in gain adjustment. This operation is repeated a specified number of times. The amount of shift in balance is calculated from the read TE data, which is output from the TEB terminal to RF amplifier IC101 : TA8137N for automatic balance adjustment.

The target value of this adjustment is not VR but the value of TROF stored with the offset adjustment. (Fig. 1-13)

Gain and balance adjustments are executed at the optimum point in the system. So if a spindle servo is rough in test mode, the optimum settings of gain and balance adjustments can be obtained.

and balance adjustment may not be obtained. In such a case, readjust the gain and balance, or readjust them by manually turning the disc to decrease the rotation of the disc if the disc is grossly off-center.

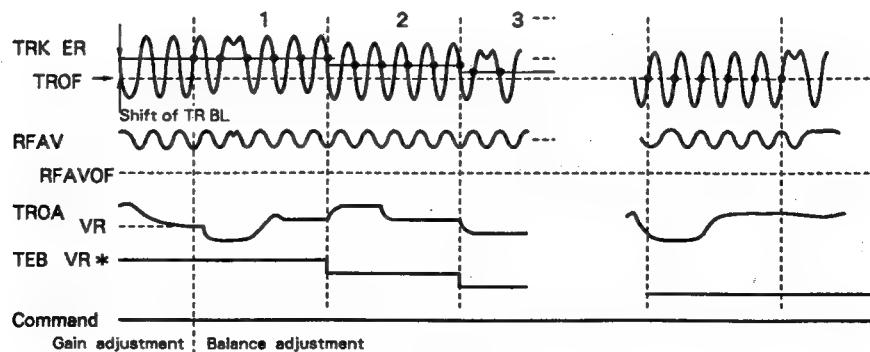


Fig. 1-19

## 4. Carriage servo system

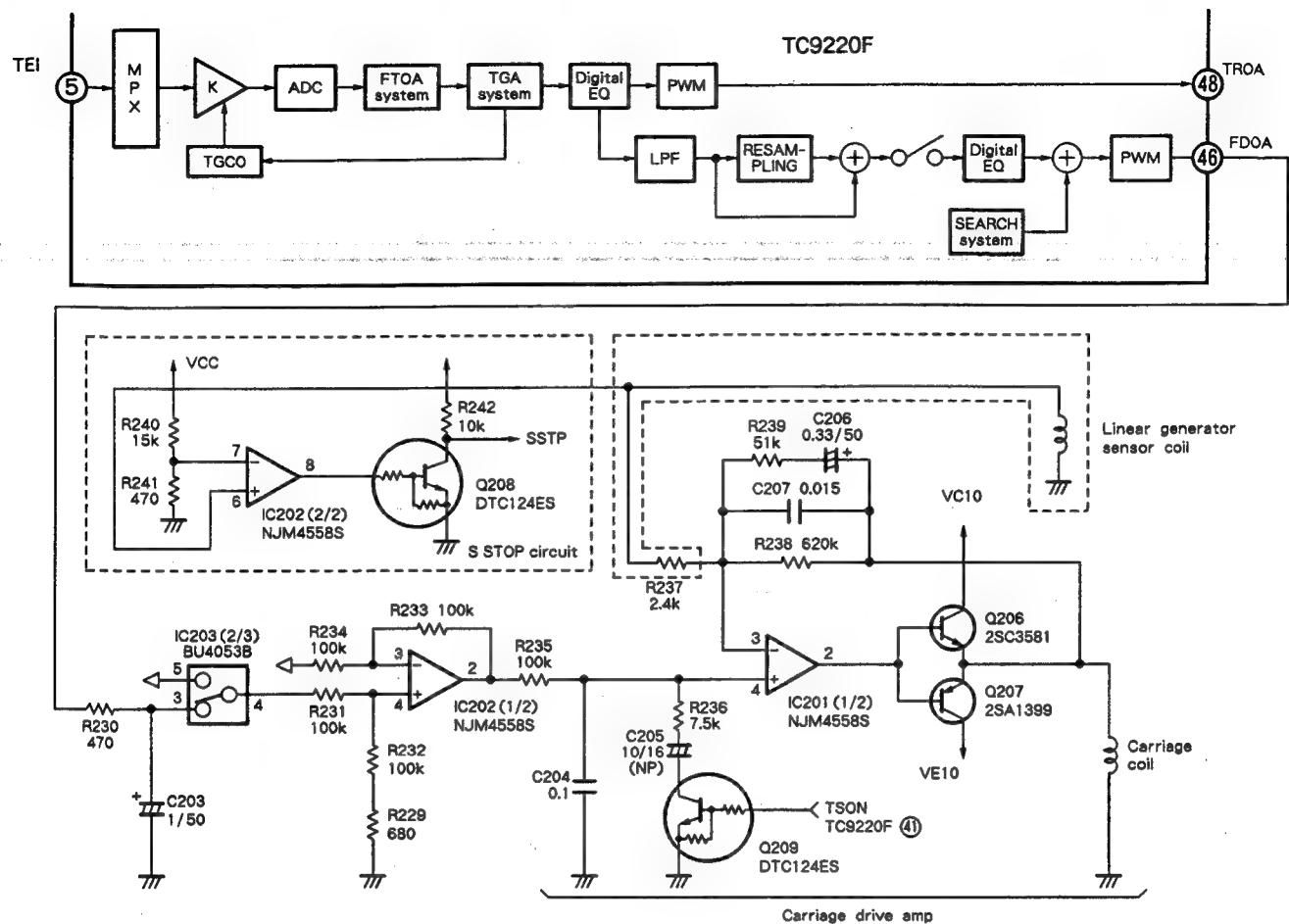


Fig. 1-20

The carriage error signal is generated from the low frequency component of the tracking error signal which has been converted from analog to digital in servo IC TC9220F.

As the carriage servo system is closed under normal conditions, the carriage can smoothly follow tracking deviation.

As this system uses a linear motor, it is provided with a carriage drive amplifier, which is optimum for a linear motor, and a speed feedback system using a DC linear generator, and S STOP circuit which generates a limit position detection signal for the innermost track.

Analog switch IC203 (2/3) is a circuit to prevent the linear motor from being activated with an offset when the power is turned on. To obtain optimum servo characteristics in normal play and search modes, the signal is switched by Q209.

## 5. Track search system

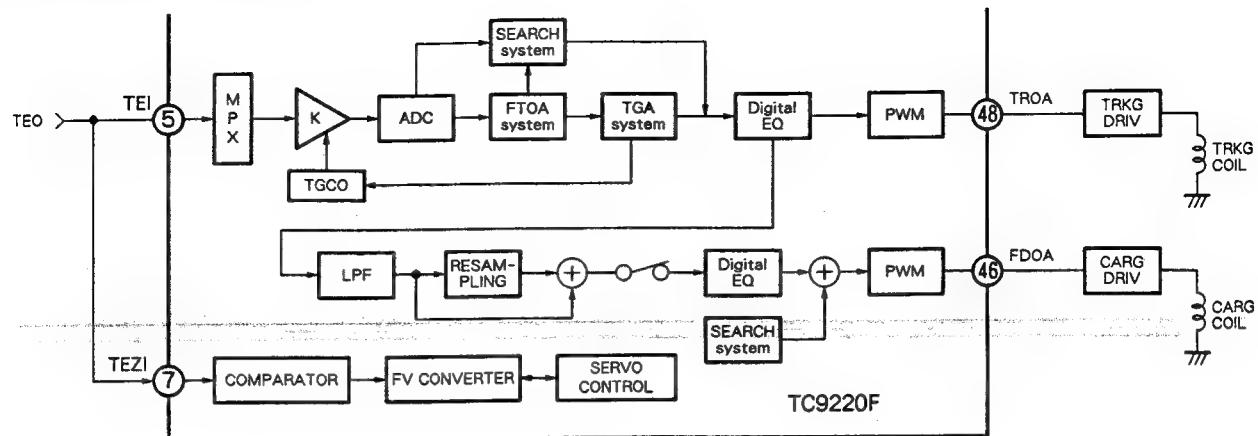


Fig. 1-21

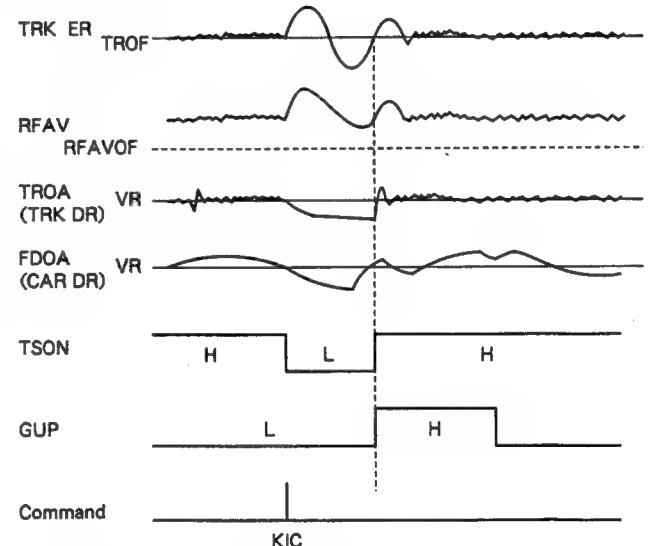
### (a) Lens kick

This system performs track search by kicking the lens. This kick is used for a small- or middle-scale search. (Fig. 1-22: Example 1 Tr. manual search, etc.) In this system, the number of tracks is counted with the A/D converted digital data, and during search, the frequency of the TE signal is always monitored with the frequency-voltage conversion circuit (FV converter). The output signal from the FV converter is feed back to the kick voltage so that the target frequency set to the optimum value for each kick is obtained. The target frequency of the FV converter varies with the number of kicked tracks. When the target track is far from the current point, the target frequency (speed) of the lens is high, and as the target track nears, the frequency becomes low.

When kicking the lens, the carriage servo is set to ON. So even if the lens is kicked a considerable number of times, the carriage will move with lens deviation. In a conventional system, the carriage should also be kicked at the same time the lens is kicked. Thus as the number of kicked tracks nears the target number for this lens kick, the kick speed is reduced, and when the target track is jumped, the speed is sufficiently reduced. To make the convergence high after kicking, gain-up for the tracking and brake operation are activated when kicking is finished. For the braking operation, the phase difference between the tracking error and RFAV signal is observed, and energy opposite to the kick direction is generated. (Fig. 1-24)

### Example 1)

FWD 1 Tr. search



Note: As TROA and FDOA are PWM output, the average values are shown in the Figure.

TSON = TRACKING SERVO ON

GUP = GAIN UP

FDOA = FEED OA output (Carriage output)

Fig. 1-22

## Example 2)

FWD 150 Tr. search

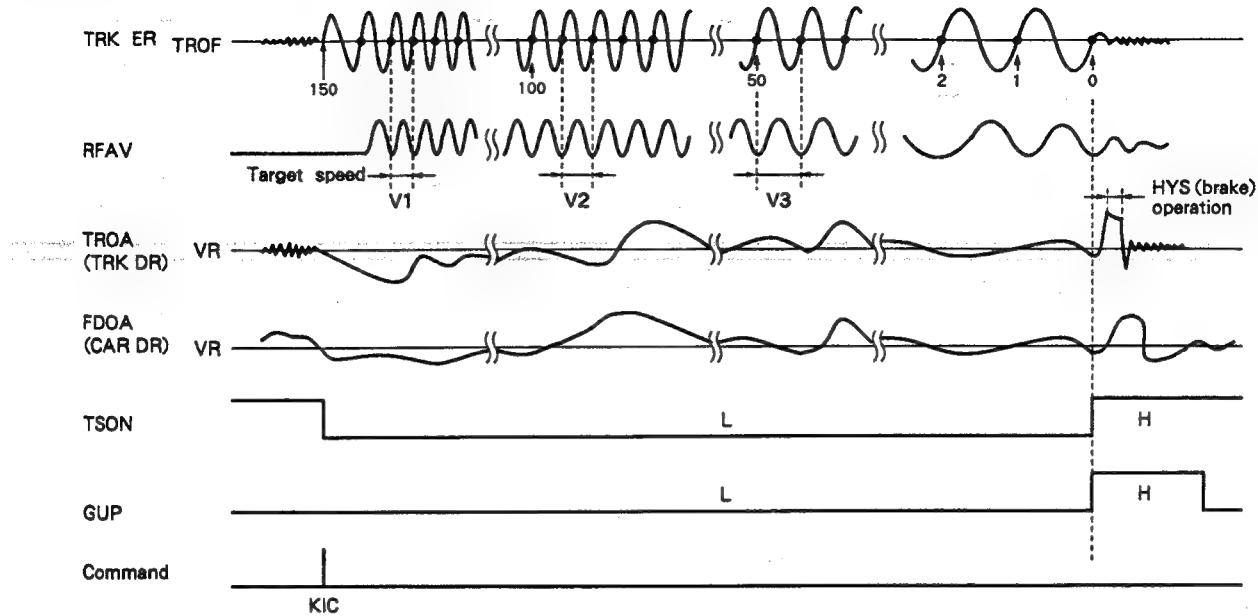


Fig. 1-23

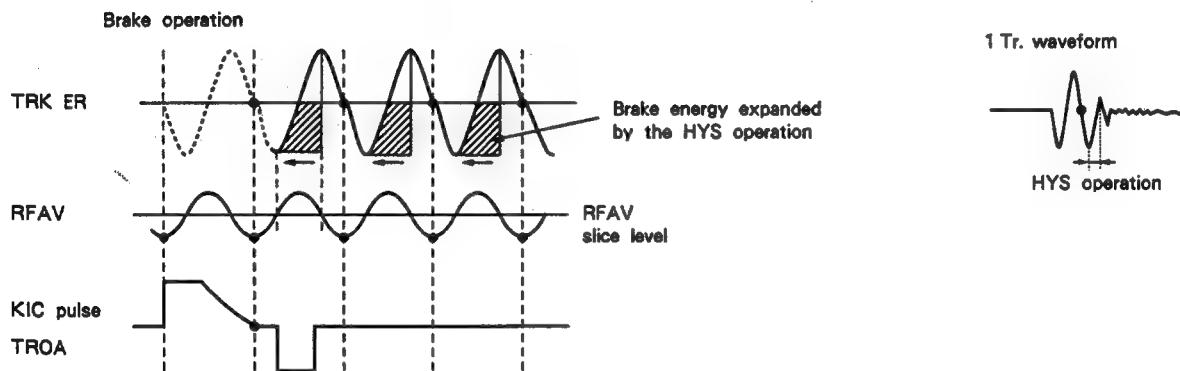


Fig. 1-24

As for GUP and HYP (brake) time, the optimum time is set for each search to obtain high convergence after a search.

In this system, when the lens speed moves in the opposite direction because of external elements such as shock, the disc being grossly off-center, etc., the direction is detected, and the search operation is stopped there.

**(b) Carriage kick**

By kicking the carriage motor, a track search is executed. In a carriage kick, the FV converter functions in the same way as with a lens kick, and the feedback function is activated to the FDOA so that the target speed is obtained depending on the number of tracks to be searched.

The timing of this kick operation is almost the same as that of a lens kick. When the kick command is sent, the tracking servo and carriage servo are set to OFF as shown in Fig. 1-21, and a kick output signal is generated by the carriage search system, and is output from the FDOA terminal.

The kick voltage is decreased to 0 when the specified number of tracks is crossed by counting them using A/D converted digital data, FV-converted analog data and the RFAV signal. After deciding that the speed is sufficiently reduced, the tracking and carriage servos are set to ON for the next track, and normal play is restored. At the same time, the gain is raised and the HYS operation is activated.

If the lens speed is faster than the target speed when the specified track is crossed, the carriage kick signal is set to 0. Then the relative speed of the lens and track is lowered to the specified value as time passes, and the tracking and carriage servos are set to ON.

REV 16000 Tr. carriage kick

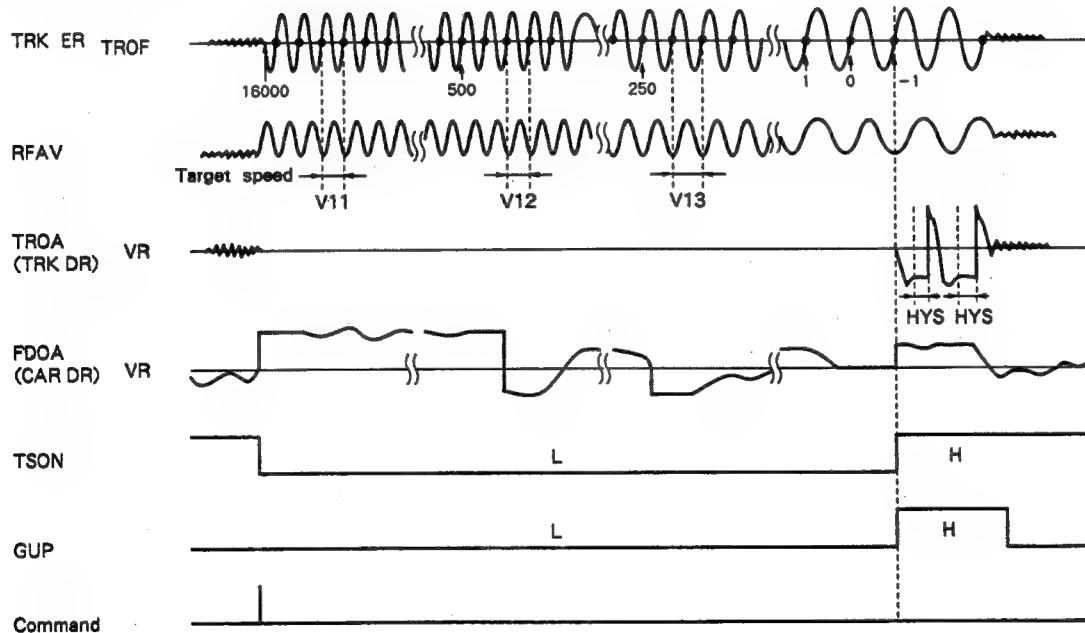


Fig. 1-25

## 6. Digital servo equalizer

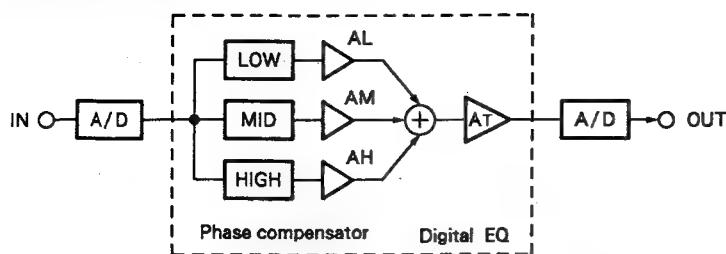


Fig. 1-26 Construction of Digital EQ

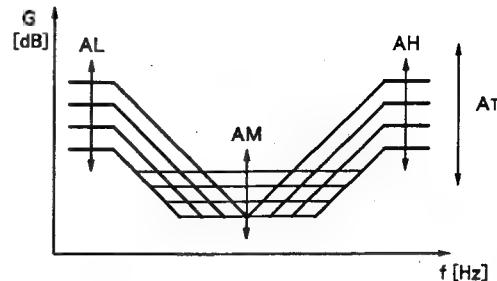


Fig. 1-27 Gain characteristic of Digital EQ

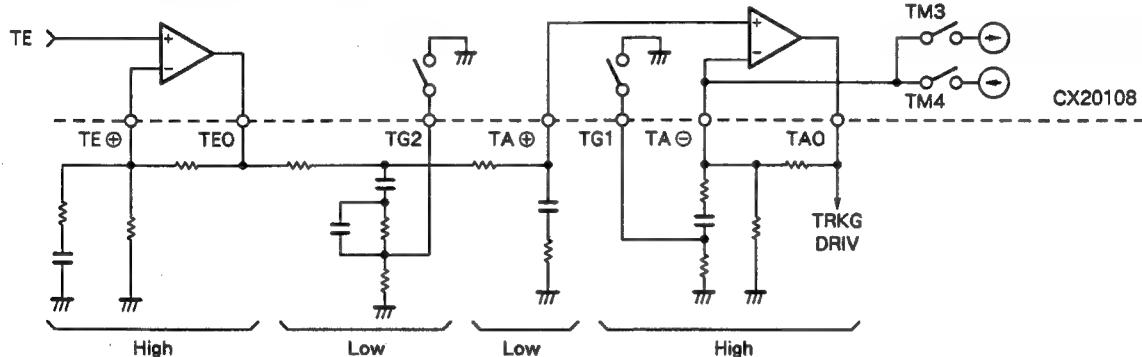


Fig. 1-28 Example of an analog equalizer circuit

For optimum servo action of the pickup, disc and motor, an equalizer is composed of operation amplifiers, resistors, capacitors, etc. in a conventional system as shown in Fig. 1-28.

In this system, a conventional analog equalizer is digitized as with a digital filter in an audio stage. An IIR (Infinite Impulse Response) type digital filter and a coefficient ROM which decides equalizing characteristics are built into the servo IC, which set the optimum equalizing characteristics for this pickup when initialized from the microcomputer. The built-in equalizer is divided into three ranges, low, middle and high as shown in Fig. 1-26 and 27, and the optimum DC level for the total system is selected from the built-in patterns. These servo equalizer characteristics as shown below are initialized when the power is turned on, but do not change in gain automatic adjustment which is executed every time a disc is changed.

- ① Focus servo equalizer
- ② Tracking servo equalizer (for normal play)
- ③ Tracking servo equalizer (for raising gain after search)
- ④ Tracking servo equalizer (for defects such as a flaw)
- ⑤ Carriage servo equalizer
- ⑥ Spindle servo equalizer

An error signal to which digital signal processing, phase compensation and gain compensation are executed, is converted from digital to analog with PWM (Pulse Width Modulation), and output from the focus, tracking, carriage and spindle terminals as ternary output (0, VR, 2VR). In this system, the PWM carrier frequency is set to 88.2 kHz.

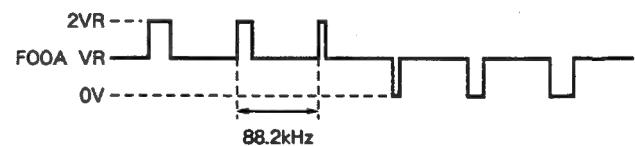


Fig. 1-29 Example of PWM drive waveform of TC9220F

## 7. Spindle motor control system

### (a) CLV control system

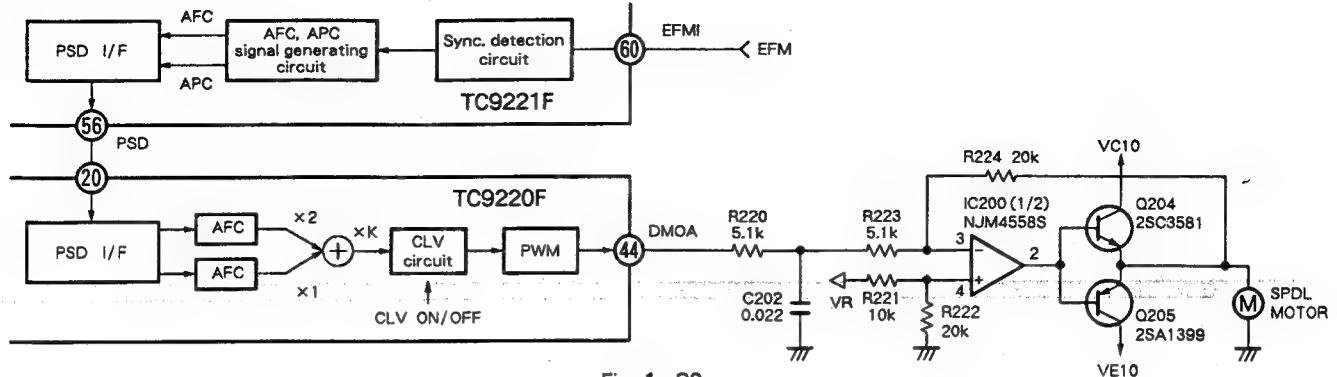


Fig. 1-30

For the spindle servo, reproduced frame signals WFCK (7.35 kHz) which are output from the sync. signal separation circuit using the EFM which is input to DSP IC from an RF amplifier are counted, and AFC data is generated. The APC data, that is the phase difference between divided waves of a master clock and WFCK, are output from the PSD terminal. Using the AFC and APC which are input to the servo IC, PWM is output from the DMOA terminal to lock the spindle motor with the CLV servo.

#### < AFC circuit >

The AFC circuit generates frequency error data which is required for the CLV servo of the spindle motor. When the spindle motor rotates at its regular speed, the frequency of the reproduced frame signal WFCK which is an output signal from a sync signal separation circuit, is 7.35 kHz. One cycle of this WFCK is counted using the master clock dividing wave, and the results are output from the PSD terminal using an interface circuit.

#### < APC circuit >

The phase difference between a clock which is obtained by dividing a master clock and that which is obtained by dividing a reproduced frame signal WFCK, is output from the PSD terminal using an interface circuit. The number of divisions for phase comparison is initially set by the microcomputer.

#### (b) Spindle motor brake circuit

The spindle motor brake circuit detects that the rotating speed of the spindle motor is sufficiently reduced when the CLV OFF command is sent from the microcomputer. In this brake system, when the microcomputer sends the CLV OFF command, DSP IC (TC9221F) counts the rotating speed using an EFM signal, and when the speed drops below the specified value, spindle deceleration is stopped, and the servo is automatically set to OFF.

## 8. Servo IC ↔ DSP IC interface

This system and the microcomputer communicate using six terminals of BUCK, BUS 0 to 3 and CCE of DSP IC TC9221F. So the servo IC and microcomputer do not directly transmit data. PREB, SSD, PSD, MCK and 4MCK are used for data transmission between a servo IC and the microcomputer or a servo IC and DSP. A PREB signal is used to synchronize TC9220F and TC9221F.

#### (a) PSD input circuit

The PSD input circuit accepts commands and data from DSP TC9221F. Commands from the microcomputer to TC9221F and internal data of TC9221F are converted to serial data with a selector, and input to the PSD terminal synchronized with 4MCK.

From TC9221F, output signals from a sync. separation circuit and the disc motor brake circuit, and an audio muting output, AFC and APC output, subcode signals, the results of a correction circuit, etc. are input.

#### (b) SSD output circuit

A SSD output circuit is to output various data from a servo IC TC9220F to DSP IC TC9221F. The output data from the SSD terminal of TC9220F is serial data synchronized with 4MCK.

Major SSD data are as follows :

- ① MODE Data to show the servo operation mode
- ② FGAI Data set by the focus gain automatic adjustment
- ③ TGAI Data set by the tracking gain automatic adjustment
- ④ SRCH Data which is set to "H" during search
- ⑤ AUK Data which is set to "H" during carriage kick

### 1.3 DSP Block

The DSP block is composed of TC9221F and several peripheral circuits, and has the following functions.

1. Reproducing the bit clock using the EFM-PLL circuit
2. Demodulation of EFM data
3. Detection, protection and insertion of frame sync signals
4. Error detection and correction of C1 double and C2 triple
5. Interpolation using an average value or holding the previous value
6. Demodulation of subcode signals and error detection of sub-code Q
7. AFC/APC generation circuit for the CLV servo
8. Digital output
9. Microcomputer interface circuit
10. VCO free run frequency of the VCO automatic adjustment function

Among these, only the PLL block requires an external circuit, and the other parts are processed in DSP and servo IC TC9220F. Fig. 1-31 shows the internal block configuration of the TC9221F, and each part is explained below.

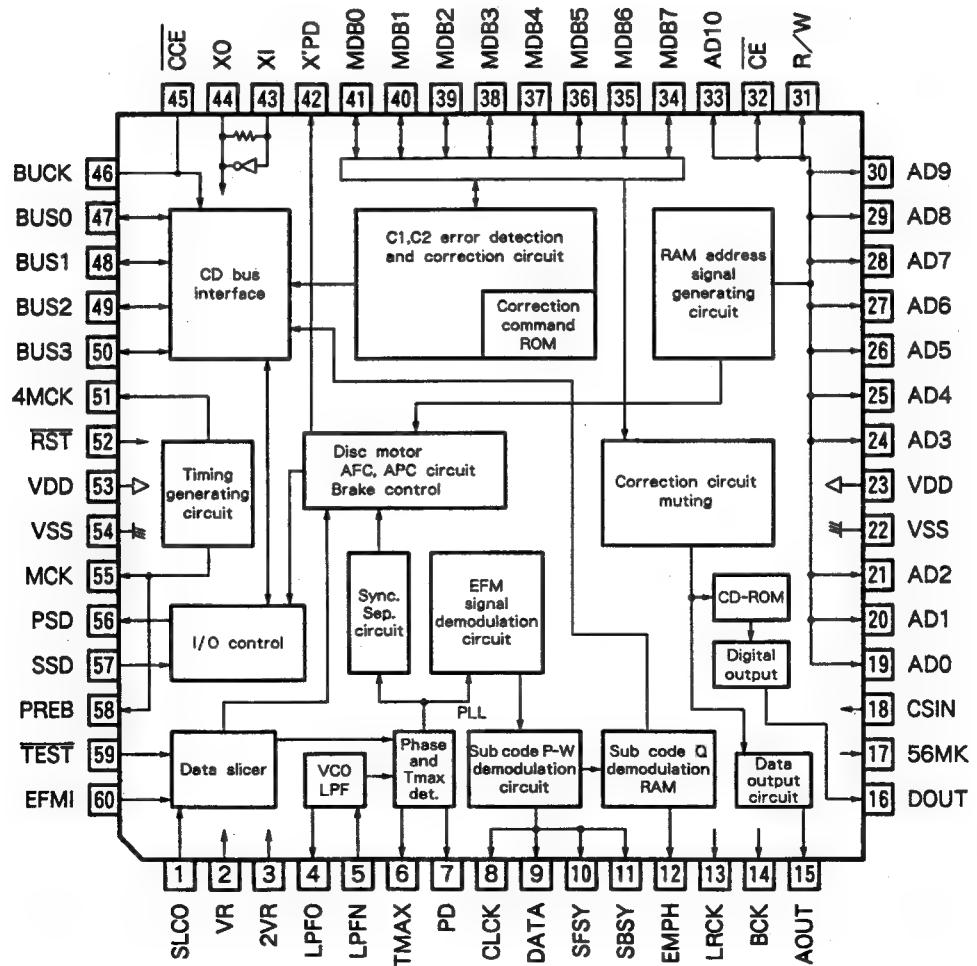


Fig. 1-31 Block diagram of TC9221F

### 1. Command code

IC100 : TC9220F and IC300 : TC9221F send data to and accept from the control microcomputer using CCE, BUCK and BUS 0 to 3. Control data for a servo IC is also transmitted through DSP.

This command includes an idle mode which accepts servo information, a write command mode which sends data to TC9221F from the microcomputer, and a read command mode which accepts data such as Q data from servo IC DSP.

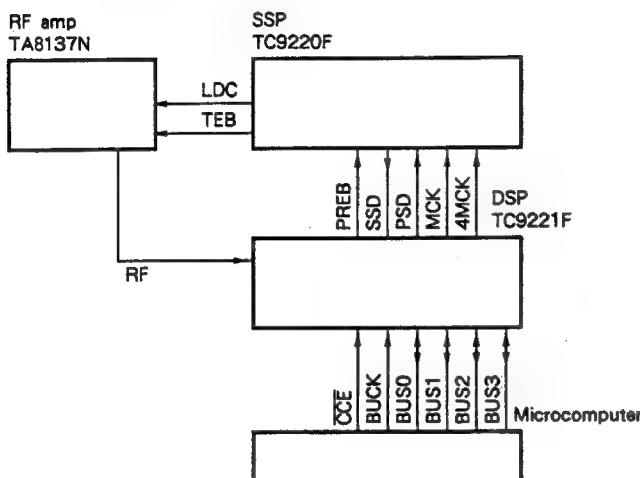


Fig. 1-32

#### (a) Idle mode

In this mode, status information (servo status) is output to BUS 0 to 3 when the microcomputer sets CCE from H to L. The internal status detected just before CCE is changed from H to L is output, and the mode is held until CCE is changed from L to H or the mode is changed to write command mode or read command mode by setting BUCK to L. So if CCE is kept at L because the pattern is short-circuited, etc., the next operation cannot start. Under correction conditions, CCE changes every time from L to H. When CCE is H, DSP IC TC9221F does not communicate with the microcomputer, but automatically operates with data transmission with servo IC TC9220F.

BUS	Servo status
0	LD OFF (LASER OFF)
1	LD ON (LESER ON)
2	FGA (FOCUS GAIN ADJUST)
3	FS (FOCUS SEARCH)
4	NONP1 (NONPLAY CLV SERVO OFF)
5	NONP2 (NONPLAY CLV SERVO ON)
6	TGBA (TRACKING GAIN/BALANCE ADJ.)
7	NP (NORMAL PLAY QDRC NG)
8	SEARCH (TRACKING SEARCH)
9	DMBK (DISC MOTOR BRAKE)
A	OFFADJ (OFFSET ADJUST)
B	FTOA (FOCUS/TRACKING OFFSET ADJ.)
C	
D	
E	INIT (INITIALIZE)
F	NP (NORMAL PLAY QDRC OK)

eg. status 7  
 BUS3 = L  
 BUS2 = H  
 BUS1 = H  
 BUS0 = H  
 ↓  
 LHHH = 0111 (binary notation)  
 = 7 (hexadecimal notation)

Table 1-1 Servo status output

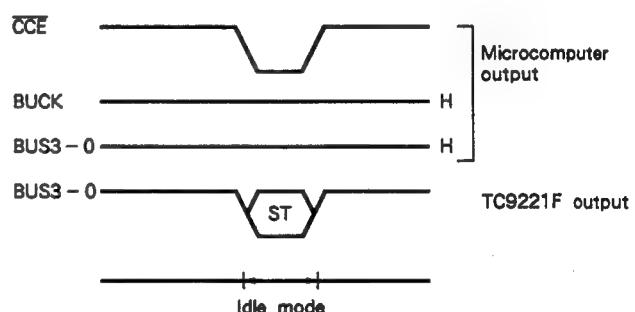


Fig. 1-33

## (2) Write command input mode

In this mode, the microcomputer sends data to TC9221F. The microcomputer sets the  $\overline{CCE}$  terminal from H to L, and a command of four words is output to the BUS 3 to 0 terminals synchronizing with the trailing edge of BUCK. The microcomputer keeps BUS 3 to 0 terminals at H in modes other than data output. After accepting the data of four words, the TC9221F outputs the ACK signal of L when the number of clocks which is input to BUCK and the results of comparison of each BUS data at the rising and trailing edges of BUCK are normal, and BUCK is L. If the results are not normal, the ACK signal is set to H. Note: An ACK (acknowledge) is a flag which shows the decision whether signal reception is OK or not.

Note: Data of status, etc. are hexadecimal notation.

0000 = 0

0001 = 1

1001 = 9

1010 = A

1011 = B

1100 = C

1101 = D

1110 = E

1111 = F

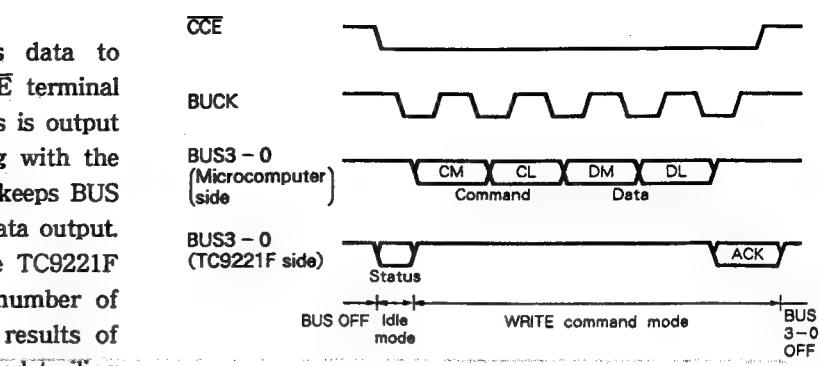


Fig. 1-34 Write command input mode timing

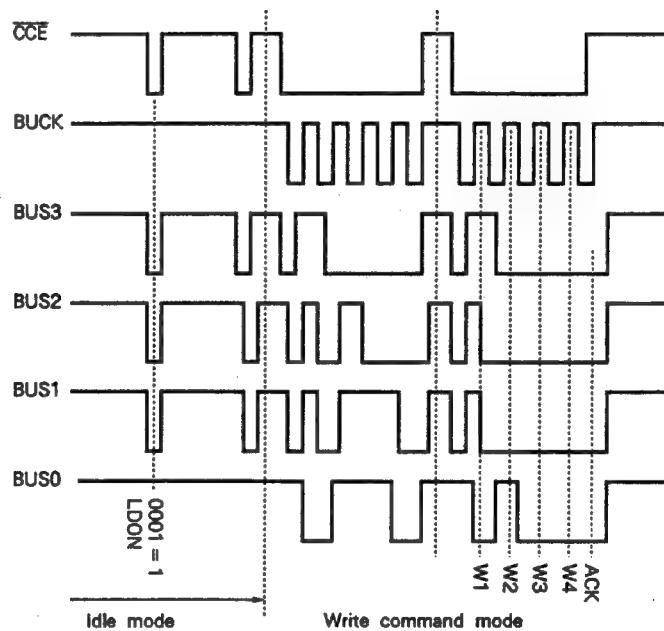


Fig. 1-35 Example of confirmed command send and accept

## (3) Read command mode

The microcomputer sets the  $\overline{CCE}$  terminal from H to L, and a read command of one word is output to BUS 3 to 0 terminals synchronizing with the trailing edge of BUCK. There are two read commands, a Q-DATA read command (Q DRC) and a STATUS read command (SRC 1 to 7).

When data transmission from TC9221F with the read command is finished, even parity for each bus is output from BUS 3 to 0 until the  $\overline{CCE}$  terminal is changed from L to H.

Note: A STATUS read command is the command to read the results of servo status, gain adjustment, etc.

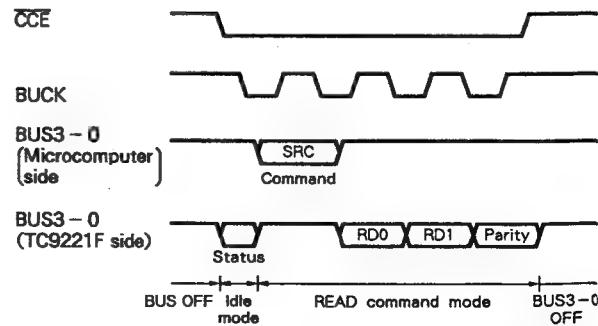


Fig. 1-36 Read command input mode timing

## 2. Data slicer and PLL circuit

### (a) Data slicer

A data slicer is a circuit to obtain binary digital signals by slicing an RF signal which is input from the EFMI terminal with the voltage which is output from the SLCO terminal.

There are three slice modes as described below. The mode to be used is selected according to servo status.

#### ① Integral slice mode

The difference of time integral amounts in the period when an EFM signal is H and in the period when an EFM signal is L, is detected, and the signal is always sliced at the median of the eye pattern.

#### ② Edge detection slice mode

The phase difference between the rising edge of PLCK and an EFM signal is detected, and the signal is sliced at the median of the eye pattern.

#### ③ Fixed slice mode

The slice level is fixed so that noise from the off tracks is ignored during search.

### (b) PLL circuit

Fig. 1-37 shows the basic configuration of the PLL circuit. The PLL circuit extracts a bit clock from an EFM signal (PLCK). When PLL is locked, PLCK (IC300 : TC9221F, pin 17) is 4.3218 MHz, and the built-in VCO generates 17.2872 MHz, four times the PLCK frequency. As an analog PLL system is used, wide capture and lock range and stable locking are achieved. This system is provided with a VCO free-run frequency automatic adjustment function, and when the system reference voltage VR is input to VCO, the VCO oscillates at a frequency of about 17 MHz. So a semifixed resistor for VCO adjustment, which is essential in a conventional system, is not necessary in this system.

A PD circuit detects any phase error between PLCK and an EFM signal, and ternary output of L, H and Hiz is obtained at the PD terminal having timing shown in Fig. 1-38.

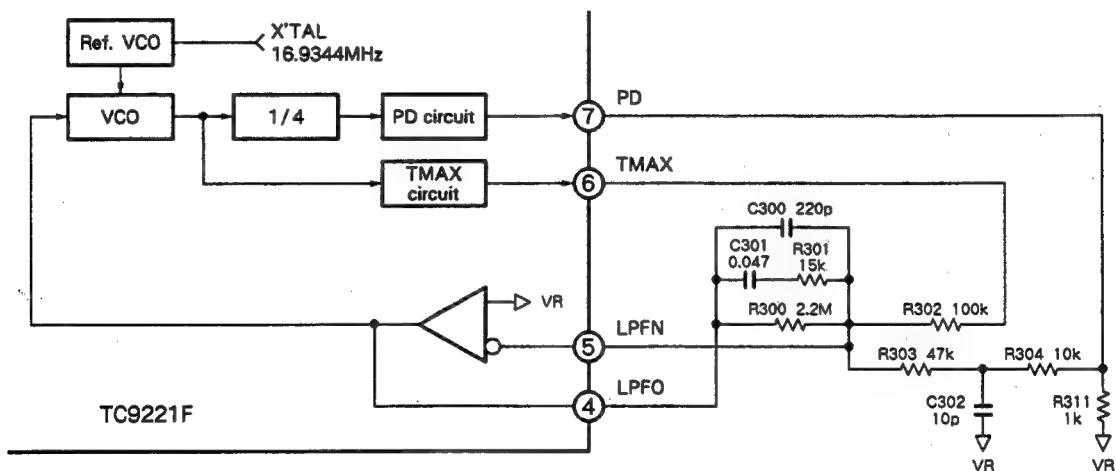


Fig. 1-37

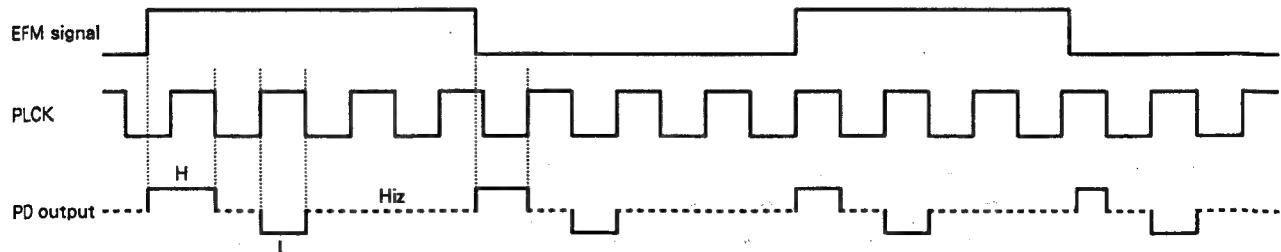


Fig. 1-38 Timing chart of phase detection

## (c) TMAX circuit

The TMAX circuit detects the maximum reverse distance of an EFM signal TMAX using a built-in VCO oscillation clock (17.2872 MHz when locked). When the counted value is less than 11T (TMAX = 11T, 1T = PLCK), (When the frequency of PLCK is less than the specified value) 2VR is output from the TMAX terminal; when it is more, L is output; when it is the specified value, Hiz is output.

This circuit operates when a PLL circuit operation is unstable and a sync signal cannot be detected normally just after power is turned on or during a search operation, to prevent mis-locking and for quick locking. TMAX is detected during a specified period of an EFM signal, and when the number of iterations set in the window is continuously detected, the output from the TMAX terminal is controlled.

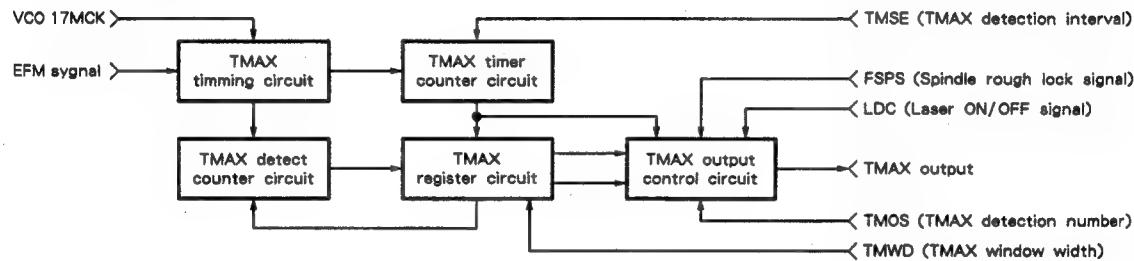


Fig. 1-39

## 3. EFM demodulation

In the EFM demodulation block, sync dividing, sync protection, insertion, EFM demodulation, subcode signal Q data demodulation, subcode signal demodulation and emphasis detection are executed.

After error detection and the decision on the demodulated subcode Q data in the unit of 98 frames (1 block), the data is stored in a built-in register. When a read command is sent, data is read through BUS 3 to 0 of DSP IC TC9221F.

In this system, error detection and correction are executed twice at two points, C1 and C2. Double error detection and correction is executed at C1, and triple at C2 (double at C2 in a conventional system). The results of detection and correction are output from the PSD terminal and servo IC (TC9220F, pin 29) EPDA as serial data.

## 4. Audio output

In this IC, a digital filter is not provided. Audio data of 1 fs MSB First is output from the AOUT terminal, and digital audio data is output from the DOUT terminal. BCLK is 1.4112 MHz (DF OFF in a conventional Sony system is 2.1168 MHz), and a WDCK signal for a digital attenuator is generated in an external circuit. A digital audio interface has two series of output, coaxial and optical. A digital signal which is output from DSP IC300 is converted to formatted output of 0.5 Vp-p in the IC800 inverter driver and L800 pulse transformer. The optical output is connected to optical driver JA800.

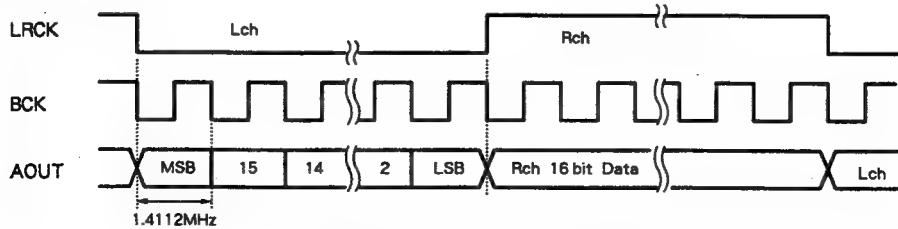


Fig. 1-40 Audio data output

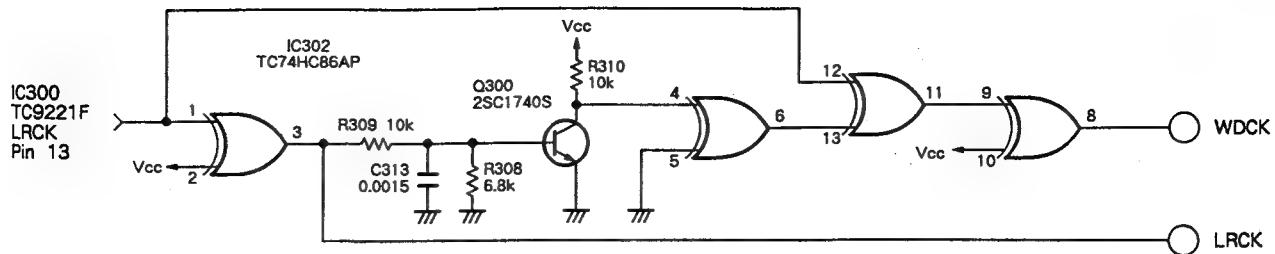


Fig. 1-41 WDCK generating circuit

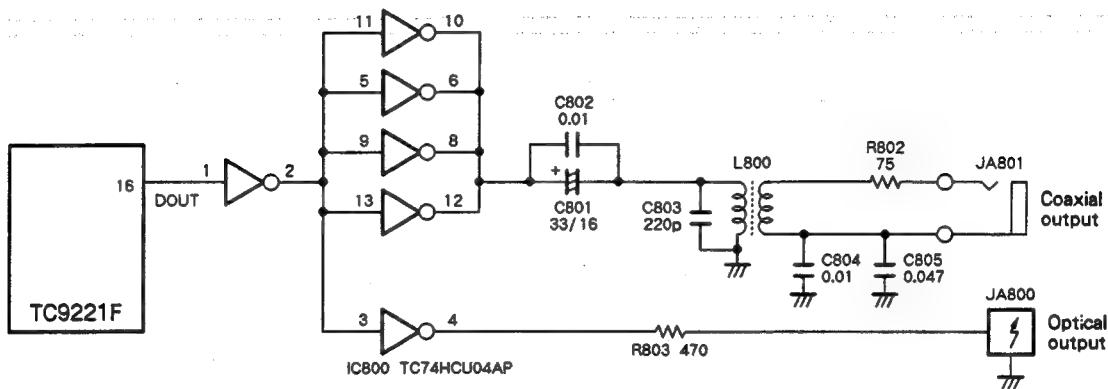


Fig. 1-42 Digital audio interface

## 1.4 Digital filter

In this system, a digital filter of 8-times-sampling 18-bit output type is used. Operation is executed by connecting three stages FIR  $153 + 29 + 17$ .

## 1.5. Audio block

## 1. D/A converter

The 20-bit data which is obtained by 8-times-sampling with a digital filter is converted from digital to analog with D/A converters IC730 and IC731. This converter is a resistor-ladder type D/A converter, and outputs current (MAX  $\pm 2$  mA). Then the current is converted to voltage in the next stage, IC750 (1/2) and IC751 (1/2), and an output voltage of  $\pm 10$  Vp-p is obtained.

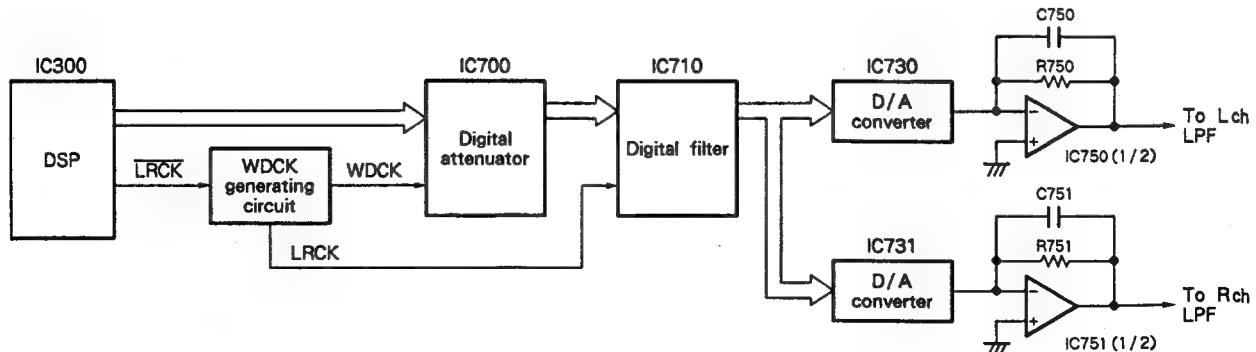


Fig. 1-43

## 2. De-emphasis and low-pass filter

The output of an I/V amplifier is input to the two-stage LPF (Low Pass Filter) which includes a de-emphasis circuit. When de-emphasis is ON, it is controlled in Q751 and Q752 with the control microcomputer. The LPF is a two-stage tertiary Butterworth type filter. With an FET buffer in the latter stage of IC770, high quality sound is achieved.

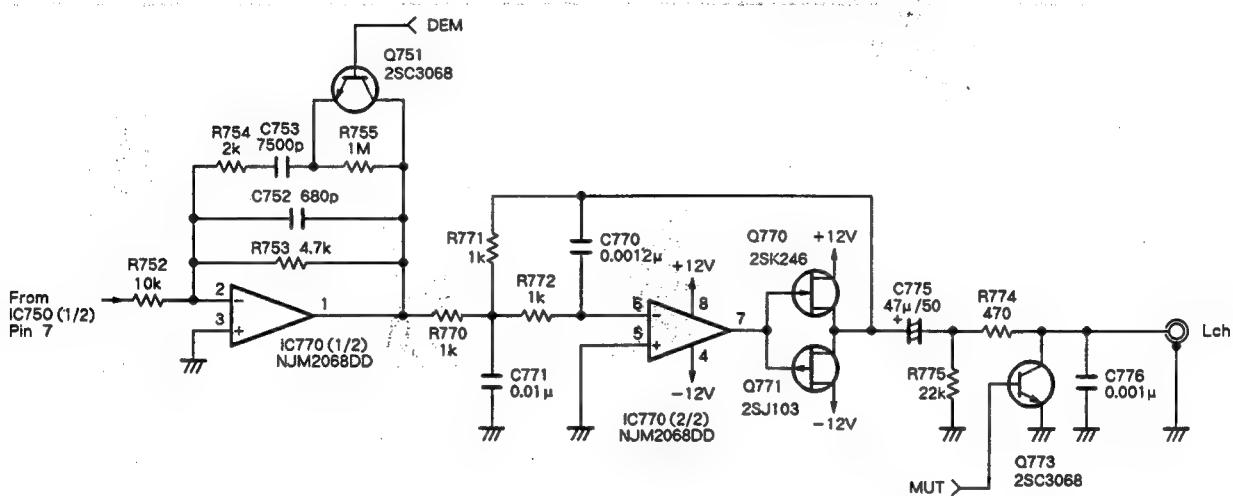


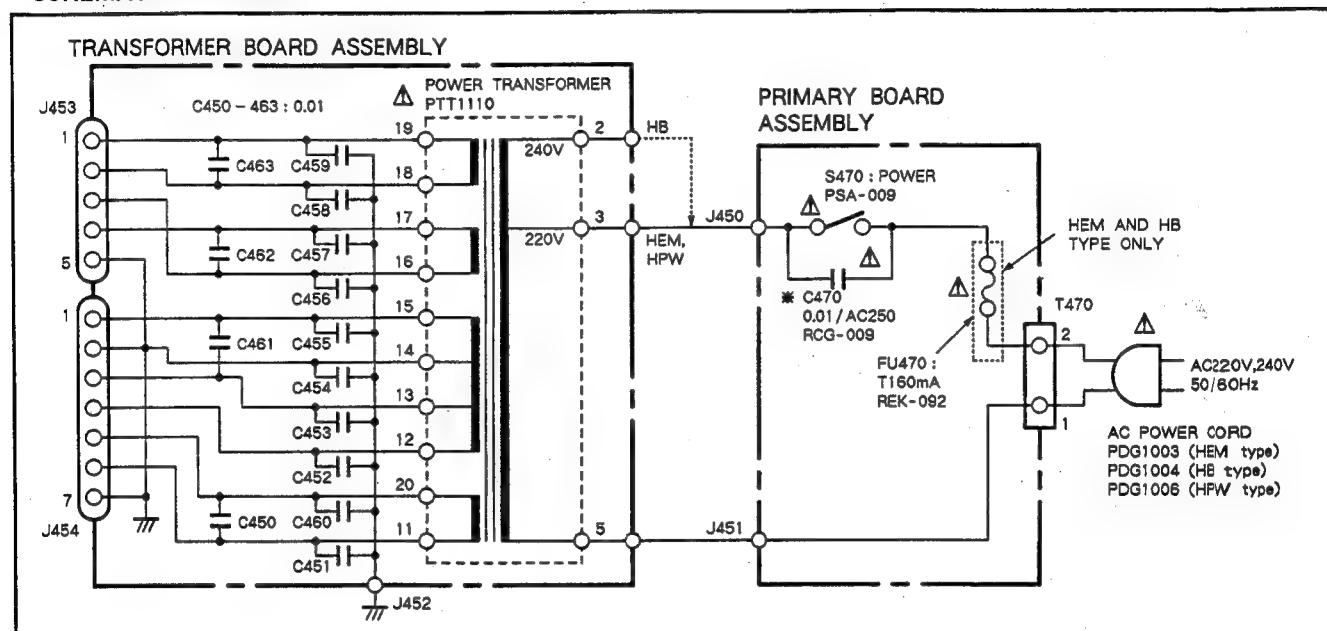
Fig. 1-44

## 10.2 SCHEMATIC DIAGRAM AND P.C. BOARDS PATTERN

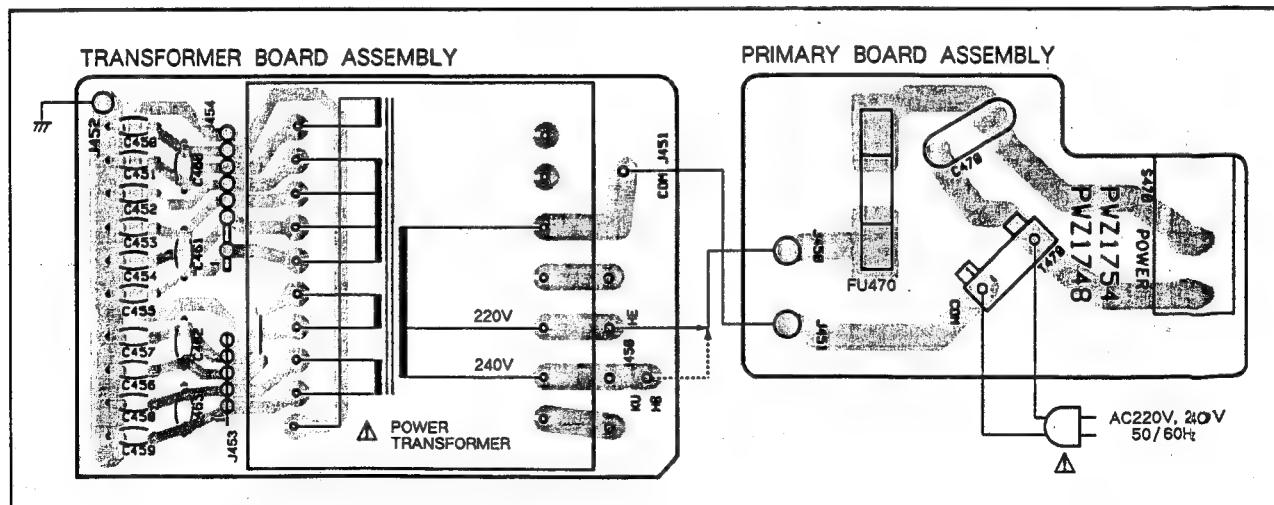
Note: The SCHEMATIC DIAGRAM and the P.C. BOARDS CONNECTION DIAGRAM of the HEM, HB, HPW and SD types are showed in the KU/CA type with the exception of the power supply section. (Pages 15-18.)

### 10.2.1 FOR HEM, HB AND HPW TYPES

#### ● SCHEMATIC DIAGRAM



#### ● P.C. BOARDS PATTERN



#### ● Line Voltage Selection

Line voltage can be changed with following steps.

1. Disconnect the AC power cord.
2. Remove the Bonnet case.
3. Change the connection of the primary lead wires (J450). (Connect as shown in schematic diagram)

4. Stick the line voltage label on the rear panel.

Description	Part No.
220V label	AAX-193
240V label	AAX-192



## 6. P. C. B's PARTS LIST

### NOTES :

- Parts without part number cannot be supplied.
- Parts marked by "◎" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.
- The △ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- When ordering resistors, first convert resistance values into code form as shown in the following examples.

Ex.1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).

560 Ω → 56 × 10<sup>1</sup> → 561 ..... RD1/4PS 5 6 1 J  
 47k Ω → 47 × 10<sup>3</sup> → 473 ..... RD1/4PS 4 7 3 J  
 0.5 Ω → 0R5 ..... RN2H 0 R 5 K  
 1 Ω → 010 ..... RS1P 0 1 0 K

Ex.2 When there are 3 effective digits (such as in high precision metal film resistors).  
 5.62k Ω → 562 × 10<sup>1</sup> → 5621 ..... RN1/4SR 5 6 2 1 F

Mark	NO	Description	Part NO.
<b>◎ SUB BOARD Assembly (PWX1133)</b>			

### SEMICONDUCTORS

IC601	MICROCOMPUTER	PDG036
Q601-603		DTA124ES
Q604-606	TRANSISTOR	2SC1740S
D601		SLH-34MC3H3
D602		SLH-34YC3H3
D603		SLH-56VC3H

### SWITCHES

S601-607	SWITCH (STOP, OPEN/CLOSE, PLAY, PAUSE, DISPLAY OFF, TRACK SEARCH (<<I, >>))	PSG-065
----------	--------------------------------------------------------------------------------------	---------

### CAPACITORS

C601	CERAMIC CAPACITOR	CKCYF103Z50
C602	CERAMIC CAPACITOR	CKDYF473Z50
C603	ELECTROLYTIC CAPACIT	CEAS330M16
C604	CERAMIC CAPACITOR	CKCYF103Z50

### RESISTORS

All resistors	RD1/6PM □□□ J
---------------	---------------

### OTHERS

V601	FLUORESCENT INDICATOR TUBE	PEL1047
X601	CERAMIC RESONATOR	VSS1014
REMOTE SENSOR		GP1U52X

## ◎ MAIN BOARD Assembly (PWZ1751)

### SEMICONDUCTORS

IC100		TC9220F-002
IC101	PRE AMP·IC	TA8137N
IC200-202		NJM4558S
IC203		BU4053B

△ IC30 IC PROTECTOR ICP-N10

IC300		TC9221F
IC301	MEMORY IC	CXK5816PN-12L
IC302	LOGIC IC	MC74HC86N
△ IC31	IC PROTECTOR	ICP-N10
△ IC32	IC PROTECTOR	ICP-N15

Mark	NO	Description	Part NO.
------	----	-------------	----------

△	IC350	MICROCOMPUTER	PD3165A
△	IC406		NJM7905FA
△	IC407		NJM7805FA
	IC408	SYSTEM RESET IC	MS1957AL
	IC700		PD0026A

△	IC710	IC	SM5813AP
	IC800	IC	MC74HCU04N
△	D400		RB-152LF
△	D412		10E2
△	D413	ZENER DIODE	HZS27NB2

△	D414		10E2
△	D415	ZENER DIODE	HZS5.1NB2
	D900-906	DIODE	1SS254
	Q101	TRANSISTOR	2SA1399
	Q200	TRANSISTOR	2SC3581

Q201	TRANSISTOR	2SA1399
Q202	TRANSISTOR	2SC3581
Q203	TRANSISTOR	2SA1399
Q204	TRANSISTOR	2SC3581
Q205	TRANSISTOR	2SA1399

Q206	TRANSISTOR	2SC3581
Q207	TRANSISTOR	2SA1399
Q208, 209	TRANSISTOR	DTC124ES
Q210	TRANSISTOR	DTA124ES
Q250, 251	TRANSISTOR	DTC124ES

Q252	TRANSISTOR	DTA124ES
Q253	TRANSISTOR	2SA854S
Q254	TRANSISTOR	2SC1741S
Q300	TRANSISTOR	2SC1740S
Q4	TRANSISTOR	DTC124ES

Q400	TRANSISTOR	2SA1048
Q5, 6	TRANSISTOR	DTC124ES
Q778	TRANSISTOR	DTA124ES
Q800, 900	TRANSISTOR	DTC124ES

### SWITCH

S890	SLIDE SWITCH(DIGITAL OUT)	RSH1025
------	---------------------------	---------

Mark	NO	Description	Part NO.	Mark	NO	Description	Part NO.				
<b>COILS</b>											
L100, 200		RADIAL INDUCTOR	LFA010K	C417		ELECTR. CAPACITOR	CEASR47M50				
L201, 3		RADIAL INDUCTOR	LFA010K	C430		CERAMIC CAPACITOR	CKCYF103250				
L4, 400		RADIAL INDUCTOR	LFA010K	C5		CERAMIC CAPACITOR	CCCH330J50				
L401, 710		RADIAL INDUCTOR	LFA010K	C6		ELECTR. CAPACITOR	CEAS101M10				
L800	COIL		PTL1003	C700, 701		CERAMIC CAPACITOR	CKCYB102K50				
L801, 900		RADIAL INDUCTOR	LFA010K	C710, 711		CERAMIC CAPACITOR	CCCH070D50				
<b>CAPACITORS</b>											
C1, 10		ELECTR. CAPACITOR	CEAS101M25	C712		CERAMIC CAPACITOR	CCCSL101J50				
C100		ELECTR. CAPACITOR	CEAS330M16	C713		ELECTR. CAPACITOR	CEAS101M50				
C104		ELECTR. CAPACITOR	CEAS101M25	C714		CERAMIC CAPACITOR	CKYF473Z50				
C105, 106		CERAMIC CAPACITOR	CKCYF103250	C715		CERAMIC CAPACITOR	CCCH470J50				
C11		CERAMIC CAPACITOR	CCCH100D50	C8		ELECTR. CAPACITOR	CEAS101M25				
C12		ELECTR. CAPACITOR	CEAS101M25	C800, 801		ELECTR. CAPACITOR	CEAS330M16				
C13		CERAMIC CAPACITOR	CCCSL331J50	C802		AUDIO FILM CAPACITOR	CFTXA103J50				
C14		AUDIO FILM CAPACITOR	CFTXA473J50	C803		CERAMIC CAPACITOR	CCCSL221J50				
C15		CERAMIC CAPACITOR	CCCSL271J50	C804		CERAMIC CAPACITOR	CKCYF103Z50				
C16		CERAMIC CAPACITOR	CCCSL391J50	C805		CERAMIC CAPACITOR	CKYF473Z50				
C17		AUDIO FILM CAPACITOR	CFTXA223J50	C806		ELECTR. CAPACITOR	CEAS101M10				
C19		AUDIO FILM CAPACITOR	CFTXA103J50	C807, 809		CERAMIC CAPACITOR	CKYF473Z50				
C2, 20		ELECTR. CAPACITOR	CEAS101M25	C890, 891		CERAMIC CAPACITOR	CKYF103Z50				
C200		AUDIO FILM CAPACITOR	CFTXA103J50	C9		CERAMIC CAPACITOR	CKYF103Z50				
C201		AUDIO FILM CAPACITOR	CFTXA182J50	C901, 902		CERAMIC CAPACITOR	CCCSL101J50				
C202		AUDIO FILM CAPACITOR	CFTXA223J50	C903, 904		CERAMIC CAPACITOR	CKYF103Z50				
C203		ELECTR. CAPACITOR	CEAS101M50	<b>RESISTORS</b>							
C204		AUDIO FILM CAPACITOR	CFTXA104J50	R231-234			RN1/6PQ1003F				
C205		ELECTR. CAPACITOR	CEANP100M16	R305	RESISTOR ARRAY (10K)		RA6T103J				
C206		ELECTR. CAPACITOR	CEASR33M50	Other resistors			RD1/6PM □□□ J				
C207		AUDIO FILM CAPACITOR	CFTXA153J50	<b>OTHERS</b>							
C21		AUDIO FILM CAPACITOR	CFTXA473J50	DL1, 2	FILTER		PTF1009				
C211, 213		ELECTR. CAPACITOR	CEAS330M50	JA800	OPTICAL OUTPUT JACK		TOTX178				
C218, 219		ELECTR. CAPACITOR	CEAS330M16	JA801	JACK		PKB1004				
C220, 221		AUDIO FILM CAPACITOR	CFTXA102J50	JA900	JACK		RKN1014				
C222, 223		AUDIO FILM CAPACITOR	CFTXA473J50	JA901, 902	JACK		RKN1004				
C224		ELECTROLYTIC CAPACIT	CEANP330M10	CN1	FLEXIBLE CONNECTOR		5597-21CPB				
C3		ELECTR. CAPACITOR	CEAS101M25	X350	CERAMIC RESONATOR(4MHz)		FCR4.0MC				
C300		CERAMIC CAPACITOR	CCCSL221J50	X710	XTAL RES (OSC)		PSS1001				
C301		AUDIO FILM CAPACITOR	CFTXA473J50	<b>HEADPHONE BOARD Assembly</b>							
C302		CERAMIC CAPACITOR	CCCH100D50	<b>SEMICONDUCTOR</b>							
C303		AUDIO FILM CAPACITOR	CFTXA103J50	IC500			MS218L				
C304		CERAMIC CAPACITOR	CKCYF103Z50	<b>COILS</b>							
C305		ELECTR. CAPACITOR	CEAS101M25	L500-502	RADIAL INDUCTOR		LFA010K				
C307		CERAMIC CAPACITOR	CKCYF103Z50	<b>CAPACITORS</b>							
C308		ELECTR. CAPACITOR	CEAS101M25	C500, 501	ELECTR. CAPACITOR		CEAS330M16				
C309		CERAMIC CAPACITOR	CCCH100D50	C502	AUDIO FILM CAPACITOR		CFTXA104J50				
C310		ELECTR. CAPACITOR	CEAS101M25	C503	AUDIO FILM CAPACITOR		CFTXA561J50				
C311		CERAMIC CAPACITOR	CKCYF103Z50	C504	AUDIO FILM CAPACITOR		CFTXA104J50				
C313		AUDIO FILM CAPACITOR	CFTXA152J50	C505	AUDIO FILM CAPACITOR		CFTXA561J50				
C314		CERAMIC CAPACITOR	CKCYF103Z50	C507-511	CERAMIC CAPACITOR		CKYF103Z50				
C315		ELECTR. CAPACITOR	CEAS101M25	<b>RESISTORS</b>							
C351		CERAMIC CAPACITOR	CKCYF473Z50	VR500	VARIABLE RESISTOR		PCS1002				
C352, 356		CERAMIC CAPACITOR	CKCYF103Z50	Other resistors			RD1/6PM □□□ J				
C357		ELECTROLYTIC CAPACIT	CEAS101M25	<b>OTHERS</b>							
C4		CERAMIC CAPACITOR	CCCH330J50	JA500	JACK		RKN1001				
C400, 401		ELECTROLYTIC CAPACIT	CENA222M16								
C402, 403		ELECTROLYTIC CAPACIT	CENA102M16								
C412-415		ELECTR. CAPACITOR	CEAS101M50								
C416		CERAMIC CAPACITOR	CKCYF103Z50								

Mark	NO	Description	Part NO.
<b>TRANSFORMER BOARD Assembly</b>			
<b>CAPACITORS</b>			
	C450-463	CERAMIC CAPACITOR	CKCYF103Z50
<b>PRIMARY BOARD ASSEMBLY</b>			
<b>SWITCH</b>			
△	S470	SWITCH(POWER)	PSA-009
<b>CAPACITOR</b>			
△	C470	CAPACITOR (CERAMIC)	RCG-009
<b>◎ AUDIO BOARD Assembly (PWZ1936)</b>			
<b>SEMICONDUCTORS</b>			
△	IC400		NJM7805FA
△	IC401		NJM7812FA
△	IC402		NJM7912FA
△	IC403		NJM7905FA
	IC730, 731	D/A CONVERTER, IC	PCM63P-J
	IC732, 733	IC	MC74HCU04N
	IC750, 751		NE5532P
	IC770, 771		NJM2068DD
	Q750	TRANSISTOR	DTA124ES
	Q751, 752	TRANSISTOR	2SC3068
	Q770	N-FET	2SK246
	Q771	P-FET	2SJ103
	Q772	TRANSISTOR	2SD1302
	Q773	TRANSISTOR	2SC3068
	Q774	N-FET	2SK246
	Q775	P-FET	2SJ103
	Q776	TRANSISTOR	2SD1302
	Q777	TRANSISTOR	2SC3068
	Q779	TRANSISTOR	DTC124ES
△	D404-411		10E2
<b>COILS</b>			
	L403, 404	FERRITE BEAD	VTH1013
	L701, 702	FERRITE BEAD	VTH1013
<b>CAPACITORS</b>			
	C404, 405	(2200 $\mu$ /35V)	VCH1032
	C406	ELECTROLYTIC CAPACIT	CENA102M16
	C407	ELECTROLYTIC CAPACIT	CEAS102M35
	C408	ELECTROLYTIC CAPACIT	CENA102M16
	C409	ELECTROLYTIC CAPACIT	CEAS102M35
	C410, 411	CERAMIC CAPACITOR	CKCYF103Z50
	C420-423	CERAMIC CAPACITOR	CKCYF103Z50
	C716	AUDIO FILM CAPACITOR	CFTXA103J50
	C730	ELECTR. CAPACITOR	CENA101M50
	C731	AUDIO FILM CAPACITOR	CFTXA104J50
	C732	ELECTR. CAPACITOR	CENA101M50
	C733, 734	ELECTR. CAPACITOR	CEAS101M25
	C736	AUDIO FILM CAPACITOR	CFTXA104J50
	C737	ELECTR. CAPACITOR	CENA101M50
	C738	ELECTR. CAPACITOR	CEAS330M16

Mark	NO	Description	Part NO.
	C740	ELECTR. CAPACITOR	CENA101M50
	C741	AUDIO FILM CAPACITOR	CFTXA104J50
	C742	ELECTR. CAPACITOR	CENA101M50
	C743, 744	ELECTR. CAPACITOR	CEAS101M25
	C746	AUDIO FILM CAPACITOR	CFTXA104J50
	C747	ELECTR. CAPACITOR	CENA101M50
	C748	ELECTR. CAPACITOR	CEAS330M16
	C750, 751	PL. STYRENE CAPACITOR	CQSF301J50
	C752	PL. STYRENE CAPACITOR	CQSF681J50
	C753	PL. PROPYTENE CAPACIT	CQPYA752J2A
	C754	PL. STYRENE CAPACITOR	CQSF681J50
	C755	PL. PROPYTENE CAPACIT	CQPYA752J2A
	C756-759	ELECTR. CAPACITOR	CEAS101M25
	C769	CERAMIC CAPACITOR	CKCYF473Z50
	C770	PL. PROPYTENE CAPACIT	CQPYA122J2A
	C771	PL. PROPYTENE CAPACIT	CQPYA103J2A
	C773, 774	ELECTR. CAPACIT	CENA101M50
	C775	ELECTROLYTIC (47 $\mu$ /50V)	PCH1094
	C776	PL. STYRENE CAPACITOR	CQSF102J50
	C780	PL. PROPYTENE CAPACIT	CQPYA122J2A
	C781	PL. PROPYTENE CAPACIT	CQPYA103J2A
	C783, 784	ELECTR. CAPACITOR	CENA101M50
	C785	ELECTROLYTIC (47 $\mu$ /50V)	PCH1094
	C786		CQSF102J50
<b>RESISTORS</b>			
	VR730, 731	VR	VRTB6VS104
	VR740, 741	VR	VRTB6VS104
	R750, 751	CARBON FILM RESISTOR	RDR1/2PM332J
	R774, 784	CARBON FILM RESISTOR	RDR1/2PM471J
	R406-411, 790	CARBON FILM	RD1/2PM □□□ J
			RD1/6PM □□□ J
<b>OTHERS</b>			
	JA700	JACK	PKB1011
	CN401		KPC5
	CN700		KPC10

## 7. ADJUSTMENTS

The adjustments for this unit are given below. Adjustments must be made in the order in which they are listed.

### ● Adjustments and check items

1. Focus lock and spindle lock check
2. Automatic adjustment check of the tracking balance
3. Grating adjustment
4. RF level adjustment
5. LD (Laser Diode) power check
6. Tangential adjustment
7. Radial adjustment
8. 2SB adjustment

### ● Measuring equipment

1. Dual trace oscilloscope
2. Optical power meter
3. Test disc (YEDS-7), 8 cm disc
4. Other regular measuring equipment

### ● About the test mode

#### How to activate and release the test mode

- ① To activate the test mode, turn ON the power switch (S470) with the test mode jumper short-circuited.
- ② The test mode is released by turning the power switch OFF.

The functions of the keys in the test mode are outlined in Table 7-1.

### ● Adjustment VR and their names

VR1 : Laser power

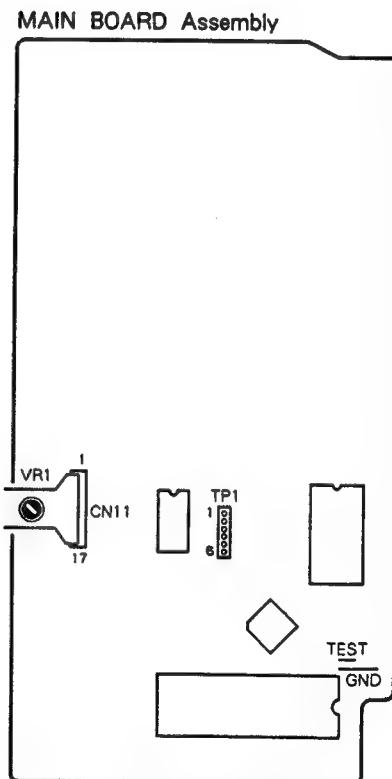


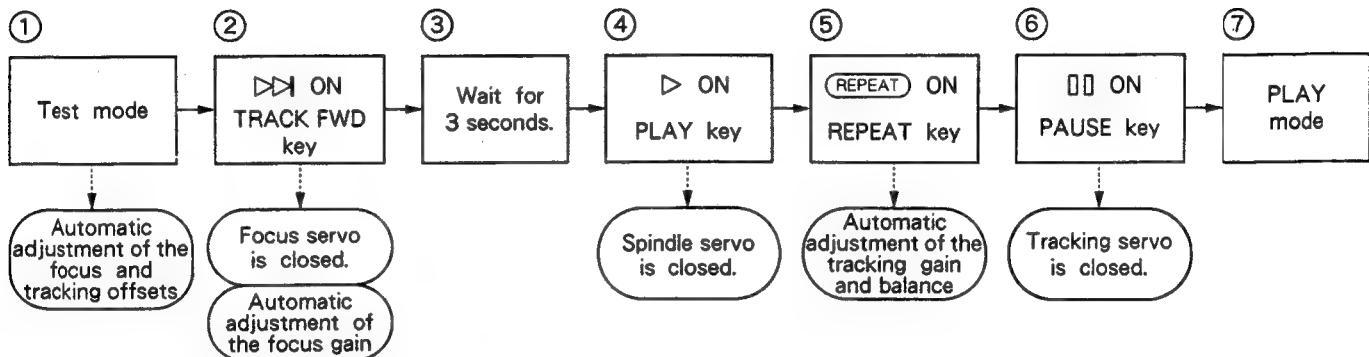
Fig. 7-1 Adjusting point

In the test mode, the servos must be closed and opened individually. Consequently, the servos must each be closed in the proper sequence (serial sequence) in order to put the machine into the play mode. Note also that the machine will not enter the play mode when the PAUSE (II) key is pressed.

For example, in order to change from the stop to the play mode, the function keys must be pressed in the following order.

\*1: The MANUAL SEARCH and REPEAT keys are not available on the panel. Use the remote control unit for these key operations. For other keys (PLAY, TRACK, PAUSE, etc.), both the panel and the remote control unit can be used.

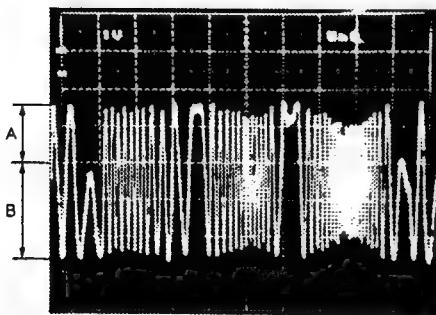
\*2: Servos in test mode are controlled in serial sequence. Note that no command is accepted in this model as long as the focus servo is not closed while the spindle is rotated in conventional models only by pressing the PLAY button.



### • Key Functions in Test Mode

Symbol	Key name	Function in test mode	Description
>>	TRACK FWD	Focus servo close Automatic adjustment of the focus gain	After illuminating the laser diode, slightly kicking the disc and moving up/down the focus actuator to adjust the focus gain, the focus servo is closed.
>	PLAY	Spindle servo close	Closes the servo in the rough servo mode after kicking the spindle motor.
(REPEAT)	REPEAT	Automatic adjustment of the tracking gain and balance	The tracking gain and balance are automatically adjusted using the error waveform in the tracking open loop condition.
II	PAUSE	Tracking servo close/open	Acts as a toggle: closes the tracking servo and activates play mode when pressed (provided the focus and spindle servos are closed), at which time the PAUSE indicator illuminates; opens the tracking servo when pressed again.
<<	MANUAL SEARCH REV	Carriage reverse (moves inward)	Moves carriage quickly (3cm/s) toward innermost track. Be careful not to move too far as there is no safety device to stop the carriage.
>>	MANUAL SEARCH FWD	Carriage forward (moves outward)	Moves carriage quickly (3cm/s) toward outermost track. Be careful not to move too far as there is no safety device to stop the carriage.
□	STOP	Stop	Stops all servos and returns system to its initial state.
△	OPEN/CLOSE	Disc tray open/close	Opens and closes the disc tray. However, pickup does not return to rest on OPEN, and it remains stationary on CLOSE.

Table 7-1

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
1	<b>Focus lock and spindle lock check</b>					
	0.5V/div	100msec /div	TP1 Pin 1 (RF output)		RF signal is output.  Forward (clockwise) rotation	<ul style="list-style-type: none"> <li>Set the test disc.</li> <li>Put unit in the test mode. (※)</li> <li>Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc. Note: Be sure to perform this operation.</li> <li>Observe the output of TP1 pin 1 (RF output) on the oscilloscope. Confirm that the RF signal is output after the TRACK FWD (▷▷) key is pressed.</li> <li>Press the PLAY (▷) key and confirm that the disc rotates at constant speed (approx. 300 rpm) near center of disc in the forward (clockwise) direction; disc may not run away or rotate counterclockwise.</li> </ul>
2	<b>Automatic adjustment check of the tracking balance</b>					
	0.5V/div	5msec /div	TP1 Pin 2 (TRK. ERR)		TRK. ERR	<ul style="list-style-type: none"> <li>Set the test disc.</li> <li>Put unit in the test mode. (※)</li> <li>While observing pin 2 of TP1 or TRK. ERR (tracking error) on an oscilloscope, adjust the DC offset to set the voltage to center on the oscilloscope.</li> <li>Press the MANUAL SEARCH FWD (▷▷) key to position the carriage near the center of the disc.</li> <li>Press the TRACK FWD (▷▷) and PLAY (▷) keys sequentially to cause the disc to rotate.</li> <li>Press the REPEAT key and check that the DC component in the tracking error is gone (A=B).</li> </ul> <p>Note :</p> <p>In normal mode, this adjustment is performed at an appropriate timing after the spindle kick. Therefore, a disc that is drastically off center may not result in A=B upon confirmation in test mode. In this case, press the REPEAT key again and check if the DC level varies.</p>
	 <p>A ≠ B</p>					
	 <p>A = B</p>					
	Photo. 7-1 DC elements mixed in signal					
	Photo. 7-2 DC elements eliminated					

※ : See page 30.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
<b>3 Grating Adjustment (1) (When an 8 cm disc is used.)</b>						
						<p>Note : This adjustment can be made by using an 8 cm disc, having pits within the diameter range of 75 mm.</p> <p>● Put unit in the test mode. (※)</p> <p>● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc, so that the grating adjustment screw of the pickup can be viewed through the oval hole (one of the oval holes which is near to the spindle motor) on the base plate of the servo mechanism.</p> <p>● As shown in Fig. 7-2, insert a (slotted) <math>\ominus</math> screwdriver from the top of the mechanism and check that the grating adjusting screw can be rotated.</p> <p>● Mount the test disc.</p> <p>● Press the TRACK FWD (▷▷), PLAY (▷) and REPEAT keys in sequence to close the focus servo and spindle servo (do not turn on the tracking servo).</p> <p>● Insert a 4 kHz-cutoff low pass filter between the oscilloscope and TP1 pins 2 (TRK. ERR) and 4 (GND) as shown in Fig. 7-3 and observe the waveform of TP1 pin 2 (tracking error) on the oscilloscope.</p> <p>● Insert a <math>\ominus</math> screwdriver into the grating hole, turn and find the null point (see Photo 7-3).</p> <p>● Next, slowly turn the <math>\ominus</math> screwdriver COUNTERCLOCKWISE from the null point and adjust until the waveform (tracking error signal) reaches maximum amplitude (see Photo 7-4).</p> <p>Note: Avoid applying pressure to the <math>\ominus</math> screwdriver while adjusting the screw. Doing so causes the pickup to move inward, making adjustment more difficult.</p> <p>● Lastly, make sure that there is no major fluctuation in the p-p voltage of the tracking error signal (do not insert the cutoff 4 kHz low-pass filter) when the pickup is moved to the inner and outer periphery. If there is a difference of more than <math>\pm 10\%</math> again turn the grating adjustment screw and adjust the tracking error signal to maximum.</p>

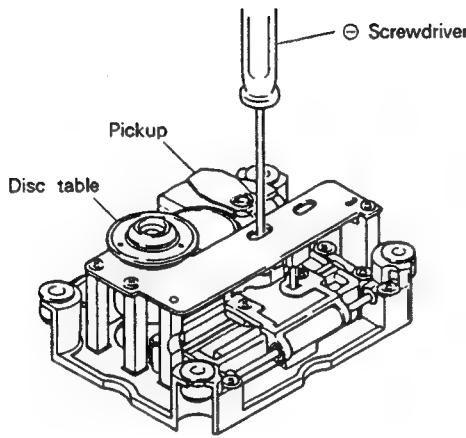


Fig. 7-2

0.5V/div	5msec /div	TP1 Pin 2 (TRK. ERR)	Grating adjustment screw	Null point
			Grating adjustment screw	Maximum amplitude

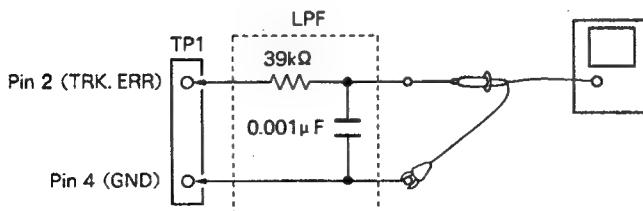
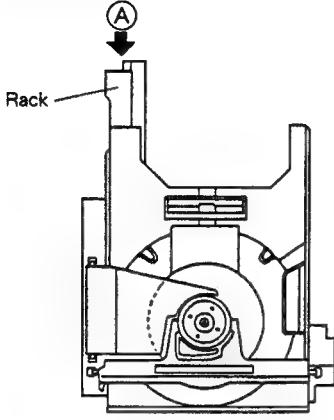
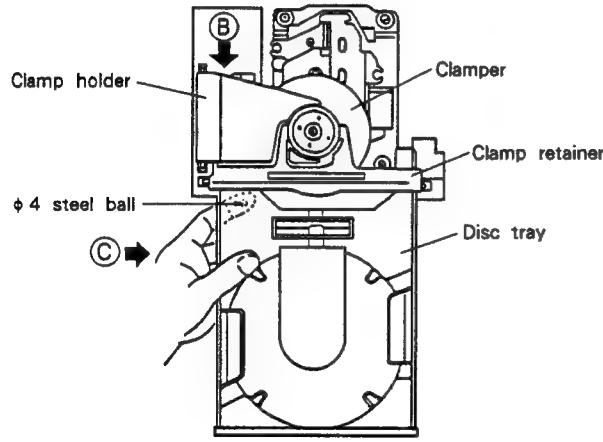
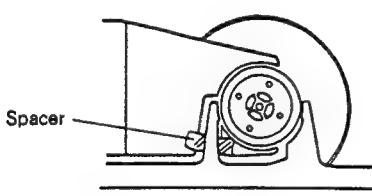
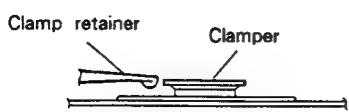
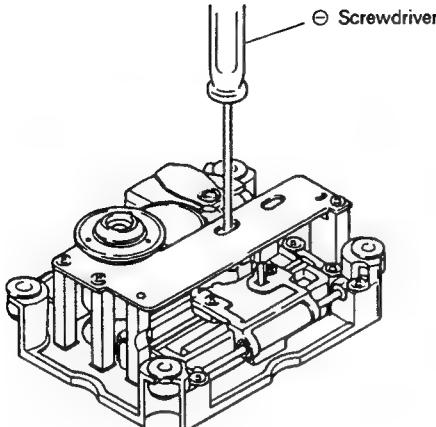


Fig. 7-3

※ See page 30.

Step No.	Oscilloscope Setting V H	Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
3'	Grating adjustment (2) (When no 8 cm disc is available.)				
	 <p>Fig. 7-4</p> <p>This adjustment is made if no 8 cm disc is available and the grating adjustment (1) cannot be effectuated. Remove the disc tray to perform this adjustment.</p> <ul style="list-style-type: none"> <li>● Removal of the disc tray             <ol style="list-style-type: none"> <li>1. Press the rear edge of the rack, (*1) marked A in Fig. 7-4, while pulling the disc tray out to the position where it catches, illustrated in Fig. 7-5.</li> <li>2. While pulling the clamp holder B (see Fig. 7-5) upward with the right hand, hold the tray as indicated by C in the left hand and pull it outward. Take care not to allow the <math>\phi 4</math> steel ball to fall (we recommend holding the ball in place with the left index finger while extracting the tray.)</li> </ol> </li> </ul> <p>(*1) When the rear edge of rack A is pressed, first the disc clamp is released. If you continue pressing after it has been released completely, the disc tray is ejected.</p>				
	 <p>Fig. 7-5</p>				
	 <p>Fig. 7-6</p>				
	 <p>Fig. 7-7</p>				

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
						 <p>Fig. 7-8</p>
						<p>● Put unit in the test mode. (※)</p> <p>● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc, so that the grating adjustment screw of the pickup can be viewed through the oval hole (one of the oval holes which is near to the spindle motor) on the base plate of the servo mechanism.</p> <p>● As shown in Fig. 7-8, insert a (slotted) <math>\ominus</math> screwdriver from the top of the mechanism and check that the grating adjusting screw can be rotated.</p> <p>● Mount the test disc; be sure to insert a 3-5 mm spacer (if no spacer is available, use a hex wrench) between the clamp holder and clamp retainer, as shown in Fig. 7-6.</p> <p>● Confirm that the clamer and the clamp retainer are not contacting one another (Fig. 7-7).</p> <p>● Press the TRACK FWD (▷▷), PLAY (▷) and REPEAT keys sequentially to close the focus and spindle servos (do not close the tracking servo).</p> <p>● Insert a 4 kHz-cutoff low pass filter between the oscilloscope and TP1 pins 2 (TRK. ERR) and 4 (GND) as shown in Fig. 7-9 and observe the waveform of TP1 pin 2 (tracking error) on the oscilloscope.</p>
	0.5V/div	5msec /div	TP1 Pin 2 (TRK. ERR)	Grating adjusting screw	Null point	<p>● Turn the grating adjusting screw with the <math>\ominus</math> screwdriver to find the null point (see Photo 7-3).</p> <p>● Next, slowly turn the <math>\ominus</math> screwdriver COUNTERCLOCKWISE and adjust to the point where the waveform (tracking error signal) first achieves its maximum amplitude (see Photo 7-4).</p> <p>Note: Avoid applying pressure to the <math>\ominus</math> screwdriver while adjusting the screw. Doing so causes the pickup to move inward, making adjustment more difficult.</p> <p>● Lastly, remove the low pass filter and confirm that the tracking error signal (do not insert the cutoff 4 kHz low-pass filter) <math>E_p</math> voltage does not greatly vary when the pickup is moved to the inner-most and outer-most tracks of the disc.</p> <p>If the levels diverge by <math>\pm 10\%</math> or more, re-adjust the maximum error amplitude point by turn the grating adjusting screw.</p>

※ : See page 30.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
						<p>Re-mount the disc tray according to the following procedure when the grating adjustment is complete.</p> <ol style="list-style-type: none"> <li>1. Remove the disc and the spacer.</li> <li>2. While lifting the clamp holder [marked ② in Fig. 7-5] with the right hand, hold the tray in the left hand as indicated by ③ and slide the slide base into the hard resin fittings on the loading base as shown in Fig. 7-10 to re-insert the disc tray.</li> <li>At this time, be sure to hold the steel ball in place with the index finger of the left hand. Also, be careful that the front panel is not damaged by the slide base and bearing of the steel ball's bearing (in the slide base) coming into contact with the panel.</li> <li>3. Insert the slide base so that it fits into the two hard resin fittings at the rear of the loading base (see Fig. 7-11).</li> <li>4. Insert the tray tightly.</li> </ol>

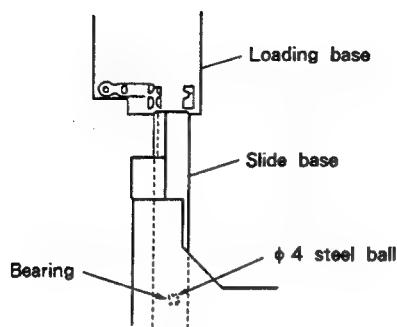


Fig. 7-10

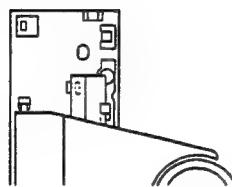
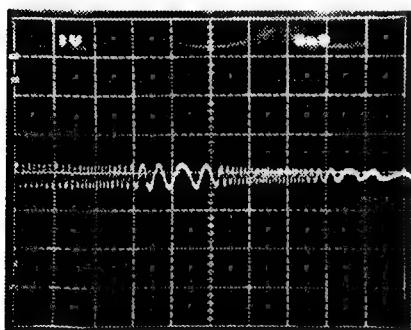
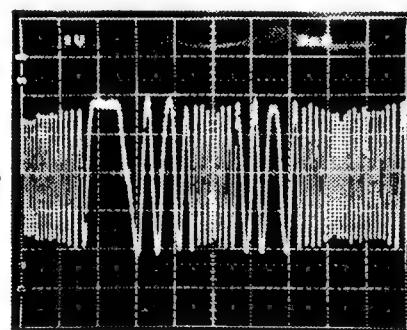
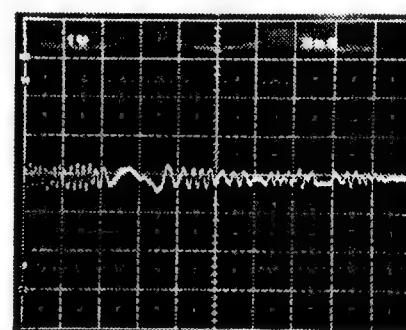


Fig. 7-11

Photo. 7-3  
Null pointPhoto. 7-4  
Maximum amplitudePhoto. 7-5  
This is not the null-point waveform.

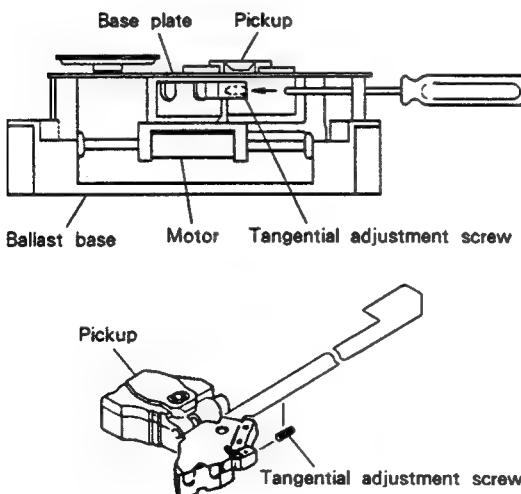
Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
<b>4 RF level adjustment</b>						
			TP1 Pin 1 (RF OUTPUT)	VR1 (Laser power)	1.5Vp-p $\pm 0.2V$ $-0.1V$	<ul style="list-style-type: none"> <li>Put unit in the test mode. (*)</li> <li>Connect the oscilloscope to TP1 pin 1 (RF output), play the test disc, and measure the P-P voltage of the RF waveform.</li> <li>Adjust VR1 (Laser power) so that the voltage is 1.5Vp-p <math>\pm 0.2V</math> <math>-0.1V</math>.</li> </ul>
<b>5 LD (laser diode) power check</b>						
				VR1	Less than 0.13mW	<ul style="list-style-type: none"> <li>Put unit in the test mode. (*)</li> <li>Press the TRACK FWD (▷▷) key to turn ON the laser diode (LD).</li> <li>Place the sensor of the optical power meter directly above the objective lens and confirm that the LD power is less than 0.13mW.</li> </ul>
<b>6 Tangential adjustment</b>						
					<ul style="list-style-type: none"> <li>Put unit in the test mode. (*)</li> <li>Open the tray and load the test disc.</li> <li>Press the MANUAL SEARCH FWD (▷▷) key to position the pickup near the center of the disc.</li> <li>Insert a hex wrench into the tangential adjustment screw section from the rear of the mechanism.</li> <li>Close the tray.</li> </ul> <p>Note: Do not use an L-shaped hex wrench. Use one such as shown to the left. Using an L-shaped hex wrench can cause the tray to come loose (see page 34 3'. Grating adjustment (2)).</p> <ul style="list-style-type: none"> <li>Press the TRACK FWD (▷▷), PLAY (▷), REPEAT and PAUSE ([]]) keys sequentially to close the all servos (PAUSE indicator will illuminate).</li> </ul>	

Fig. 7-12

\* : See page 30.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
	200nsec / div		TP1 Pin 1 RF output	Tangential adjustment screw	Sharpest possible eye pattern	<ul style="list-style-type: none"> <li>Observe TP1 pin 1 (RF output) on the oscilloscope and adjust the tangential adjustment screw to achieve the sharpest possible eye pattern.</li> <li>The point to which the adjusting screw should be set lies about halfway between the points at which the eye pattern becomes most blurred when the screw is rotated clockwise and counterclockwise. When the whole waveform becomes clear, concentrate on sharpening the fine lines forming the diamond at the center of the eye pattern (see Photo 7-7). Adjust until the fine lines on all four sides of the diamond are both sharply defined and dense.</li> </ul> <p>Note: Use a hex wrench to raise the pickup somewhat while making this adjustment.</p>

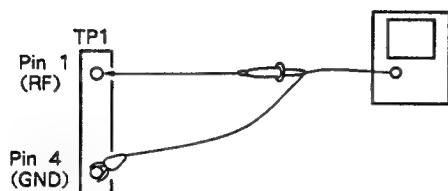


Fig. 7-13

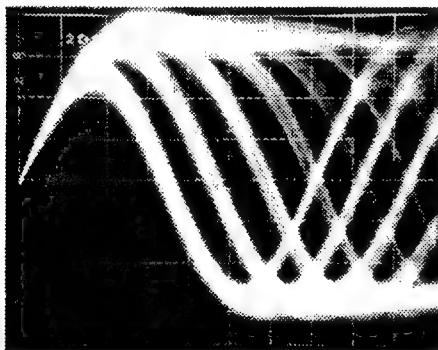


Photo. 7-6

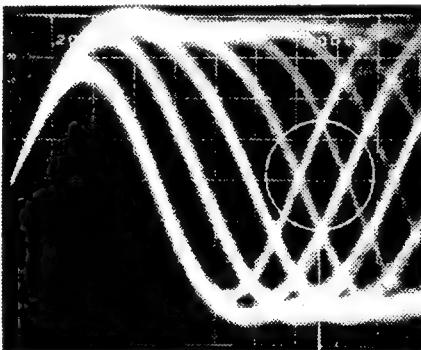


Photo. 7-7

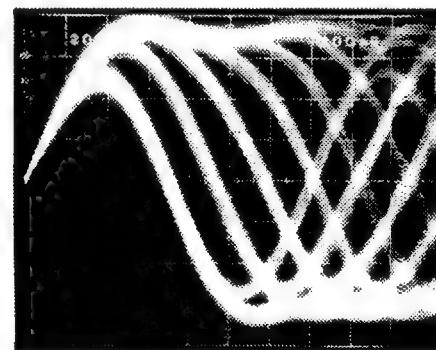
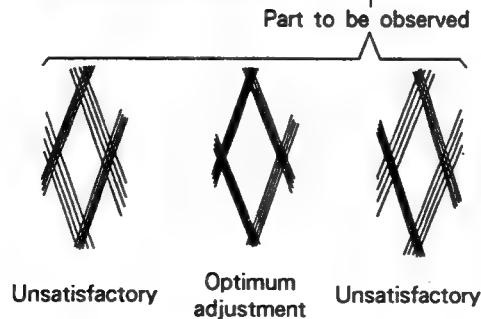


Photo. 7-8



Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
<b>7 Radial adjustment</b>						
			TP1 Pin 1 (RF output)	Radial adjustment screw	Sharpest possible eye pattern	<p>Remove the disc tray before beginning this adjustment.</p> <p>Note: Refer to page 34 "3. Grating adjustment (2)" for the removal of the disc tray.</p> <ul style="list-style-type: none"> <li>● Load the test disc.</li> <li>● Put unit in the test mode. (※)</li> <li>● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc, so that tangential adjustment screw can be viewed from the top (refer to Fig. 7-12).</li> <li>● Press the TRACK FWD (▷▷), PLAY (▷), REPEAT and PAUSE ([]]) keys sequentially to close all servos(PAUSE indicator will illuminate).</li> <li>● Observe TP1 pin 1 (RF output) on the oscilloscope and adjust the radial adjustment screw to achieve the sharpest possible eye pattern. (Fig. 7-14)</li> <li>● When the whole waveform becomes clear, concentrate on sharpening the fine lines forming the diamond at the center of the eye pattern. Adjust until the fine lines on all four sides of the diamond are both sharply defined and dense, as shown in Photo 7-7.</li> <li>● Perform the tangential adjustment and the radial adjustment twice or more alternately.</li> </ul>

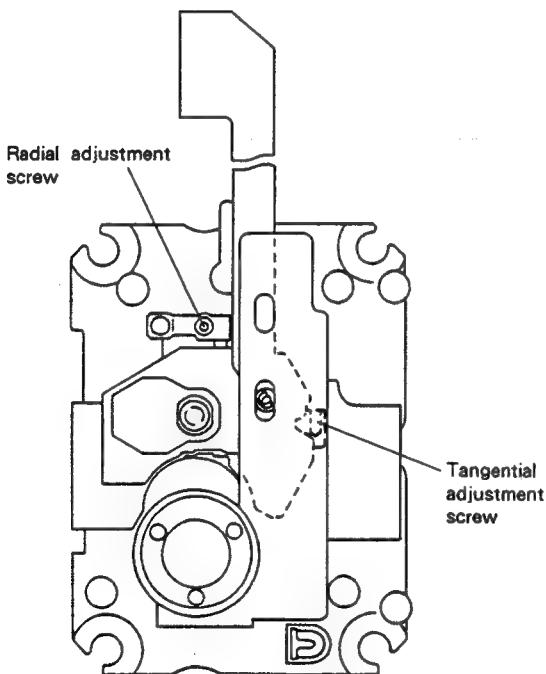


Fig. 7-14

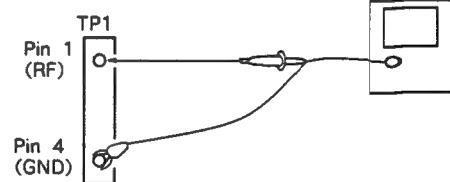


Fig. 7-15

※ : See page 30.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
8	D/A converter (2SB) adjustment					<ul style="list-style-type: none"> <li>When replacing the D/A converter For IC730 : Remove R730 through R733. For IC731 : Remove R740 through R743. (In this case, no adjustment is performed for 2SB. However, the initial condition of the performance of the D/A converter is resumed by removing the resistors.)</li> </ul>

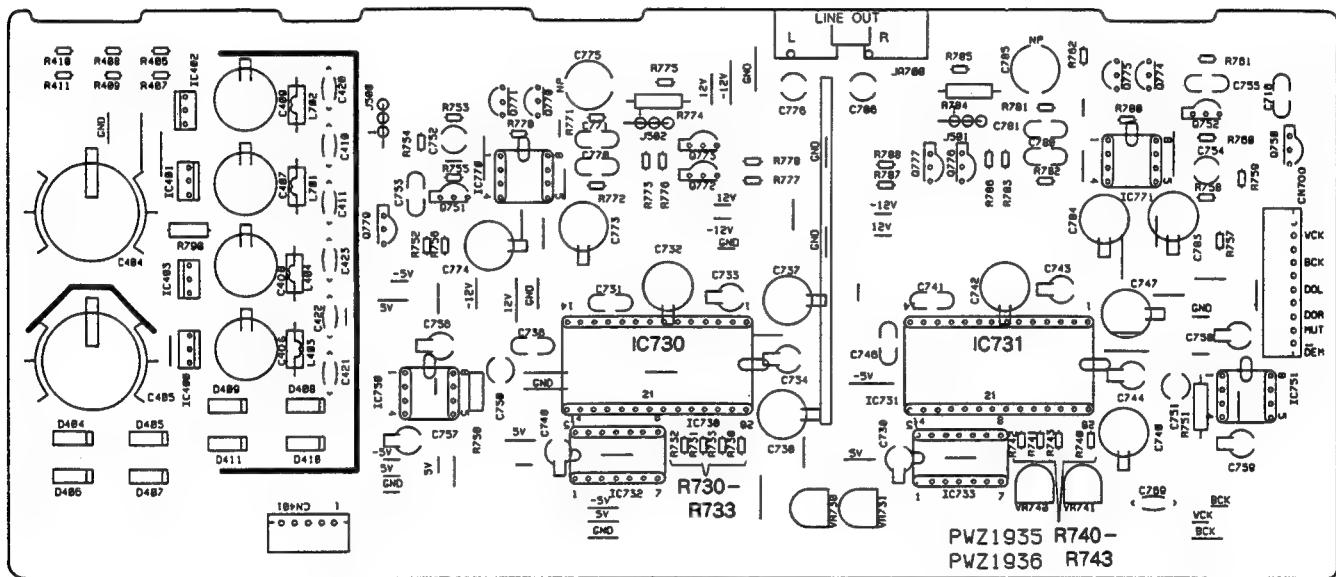


Fig. 7-16 AUDIO BOARD Assembly

## 8. IC INFORMATION

■ PD3165A

### System control microcomputer

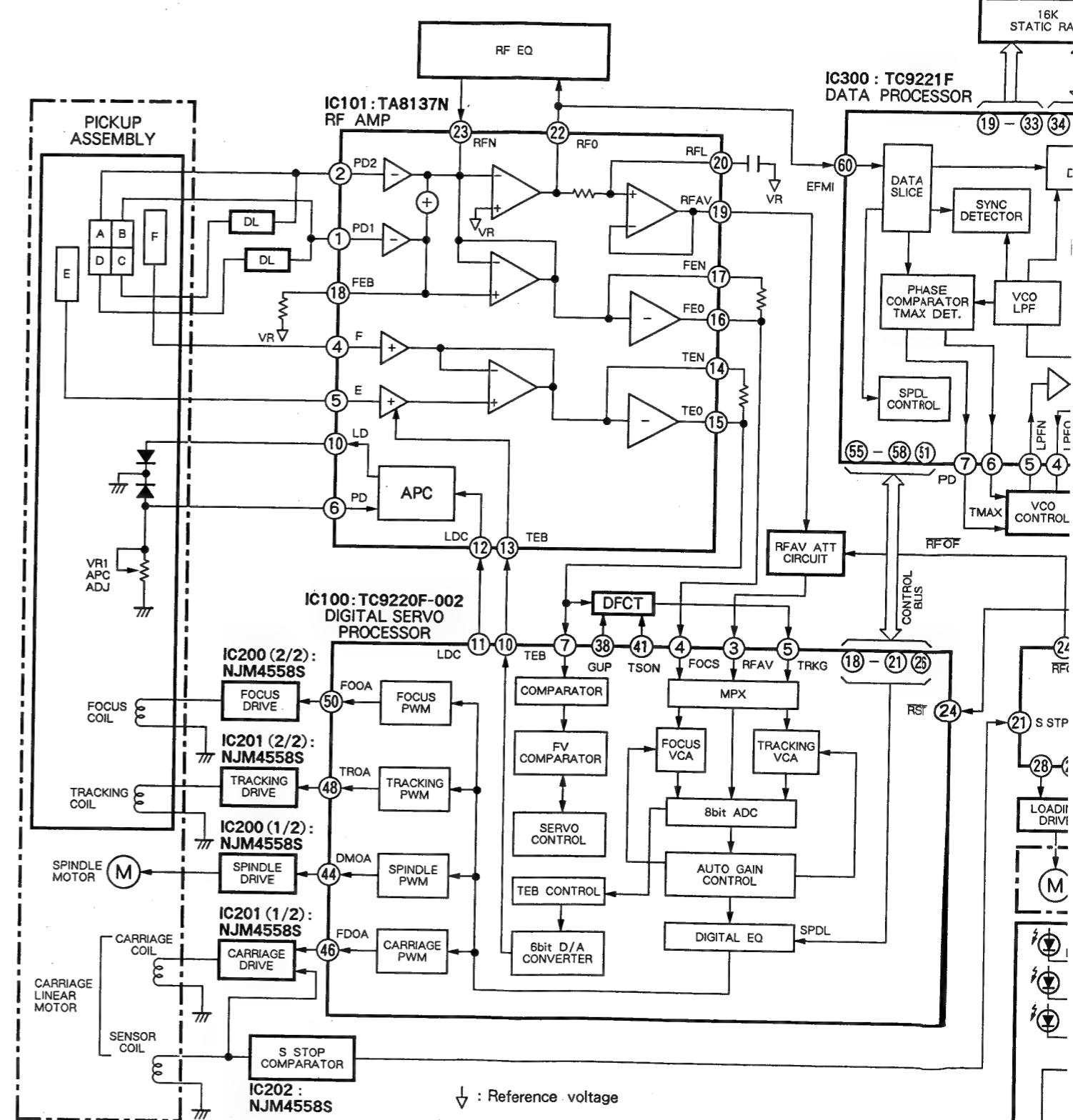
## ● Pin functions

Pin	Symbol	Name	I/O	Function		Reset	Pin	Symbol	Name	I/O	Function		Reset
1	Vss	—	—	GND		—	35	P46	ADAT	O	Attenuation level data		H
2	XTAL	—	—	Built-in clock circuit input		—	36	P45	ACLK	O	1011234567		
3	EXTAL	—	—			—	37	P44	KS	I	Attenuation level clock		H
4	MP0	—	—	+5V		—	38	P43	RKS	I	Main unit key strobe input		—
5	MP1	—	—	+5V		—	39	P42	*1	O	ON OFF		—
6	RES	—	I	CPU reset input		Reset RUN	40	P41	MDSW	I	Remote control key strobe input		—
7	STBY	—	—	CPU stand-by input		Stand-by RUN	41	P40	STS	I	(OPEN)		L
8	NMI	*1	—	+5V		—	42	Vss	—	—	GND		—
9	P20	TEST	—	Test mode SW input		TEST NORMAL	43	P17	*1	—	Display data transfer permission input		—
10	P21	SYC1	—	Input terminal for deck synchro.		—	44	P16	*1	—	Permit Inhibit		—
11	P22	SYC3	—	Output terminal for deck synchro.		L	45	P15	*1	—	GND		—
12	P23	*1	O	(OPEN)		L	46	P14	DOFF	—	(OPEN)		L
13	P24	*1	—	(OPEN)		L	47	P13	AOFF	O	(OPEN)		L
14	P25	DEMP	O	De-emphasis ON/OFF		ON OFF	48	P12	SCK	—	(OPEN)		L
15	P26	CCE	—	Chip enable		Enable	49	P11	SD	—	Display LED of digital out output condition		H
16	P27	BUCK	—	Bus clock		—	50	P10	SRES	—	ON OFF		H
17	P50	BUS0	I/O	Bus data 0		...X X X X X...	51	P37	KD7	—	Display LED of analog out output condition		H
18	P51	BUS1	—	Bus data 1		...X X X X X...	52	P36	KD6	—	(OPEN)		H
19	P52	BUS2	—	Bus data 2		...X X X X X...	53	P35	KD5	—	Display data serial transfer clock		H
20	P53	BUS3	—	Bus data 3		...X X X X X...	54	P34	KD4	—	Display data serial output		H
21	P54	SSTP	I	Slider inside detection input		NOT STOP	55	P33	KD3	—	Display data serial output		H
22	P55	DFCT	—	Defect detection input		*2 NOT Defect	56	P32	KD2	—	Key display and microcomputer reset output		L
23	P56	TSON	—	Tracking servo ON detection input		*2 NOT ON	57	P31	KD1	—	RESET RUN		
24	P57	RFOF	—	RFAV level ON/OFF switch output		ON OFF	58	P30	KD0	I	(MSB)		
25	P60	*1	O	(OPEN)		L	59	P74	*1	—	Main unit and remote control key code input		
26	P61	*1	—	(OPEN)		L	60	P73	*1	—	(LSB)		
27	P62	*1	—	(OPEN)		L	61	P72	*1	O	(OPEN)		
28	P63	LIN	—	Disc tray loading		IN	62	P71	*1	—	(OPEN)		
29	P64	LOUT	—	IN/OUT output		Brake OUT	63	P70	*1	—	(OPEN)		
30	P65	OPEN	I	OPEN end		OPEN NOT	64	E	—	—	(OPEN)		
31	P66	CLMP	—	Clamp end		CLAMP NOT	65	P74	*1	—	(OPEN)		
32	P67	*1	O	(OPEN)		L	66	P73	*1	—	(OPEN)		
33	Vcc	—	—	+5V power supply voltage		—	67	P72	*1	O	(OPEN)		
34	P47	ALAT	O	Attenuation level latch pulse output		Execute	68	P71	*1	—	(OPEN)		

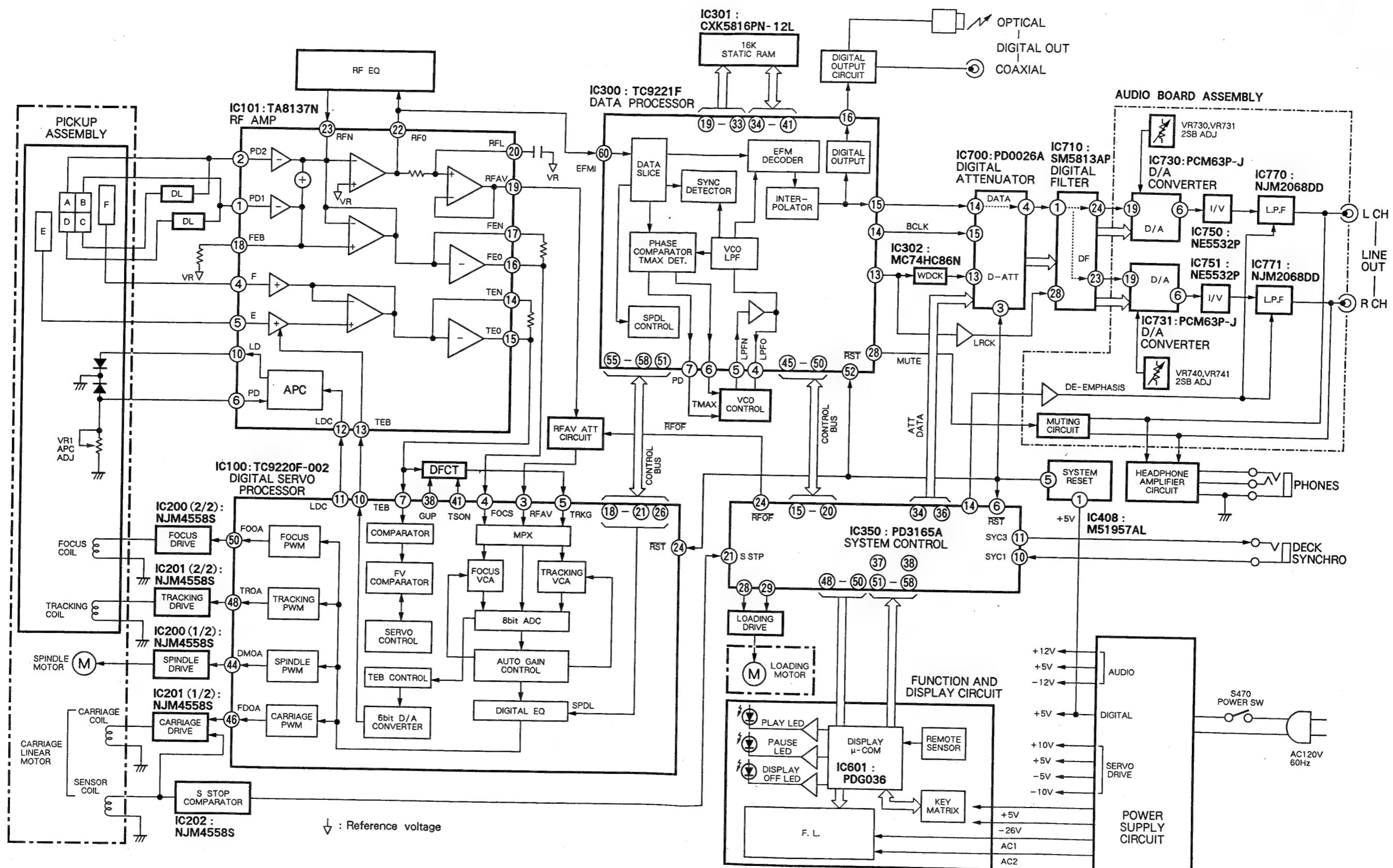
\* 1 : Not used

\* 2 : Set to input port, but these functions are not used by the use of software.

## 9. BLOCK DIAGRAM



## 9. BLOCK DIAGRAM



## 10. FOR HEM, HB, HPW AND SD TYPES

## 10.1 CONTRAST OF MISCELLANEOUS PARTS

## NOTES :

- Parts without part number cannot be supplied.
- Parts marked by "◎" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.
- The Δ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- When ordering resistors, first convert resistance values into code form as shown in the following examples.
- Ex.1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).
- 560 Ω → 56 × 10<sup>1</sup> → 561 ..... RD1/4PS 5 6 1 J
- 47k Ω → 47 × 10<sup>3</sup> → 473 ..... RD1/4PS 4 7 3 J
- 0.5 Ω → 0R5 ..... RN2H 0 R 5 K
- 1 Ω → 010 ..... RS1P 0 1 0 K
- Ex.2 When there are 3 effective digits (such as in high precision metal film resistors).
- 5.62k Ω → 562 × 10<sup>1</sup> → 5621 ..... RN1/4SR 5 6 2 1 F

The HEM, HB, HPW and SD types are the same as the KU/CA type with the exception of the following sections.

Mark	Symbol & Description	Part No.					Remarks
		KU/CA type	HEM type	HB type	HPW type	SD type	
△	Strain relief	CM-22C	CM-22B	CM-22B	CM-22B	CM-22B	
	Display screen	PAM1323	PAM1305	PAM1305	PAM1323	PAM1323	
△	Connection cord with mini plug	PDE-319	• • • •	• • • •	PDE-319	• • • •	
	AC power cord	PDG1002	PDG1003	PDG1004	PDG1006	PDG1013	
	Operating instructions (English)	PRB1130	• • • •	PRB1130	PRB1130	PRB1130	
	Operating instructions (English/German/French/Italian/Dutch/Swedish/Portuguese/Spanish)	• • • •	PRE1130	• • • •	• • • •	• • • •	
△	Power transformer (AC120V)	PTT1109	• • • •	• • • •	• • • •	• • • •	
△	Power transformer (AC220V,240V)	• • • •	PTT1110	PTT1110	PTT1110	• • • •	
△	Power transformer (AC110V,120-127V,220V,240V)	• • • •	• • • •	• • • •	• • • •	PTT1111	
◎	Main board assembly	PWZ1751	PWZ1745	PWZ1745	PWZ1751	PWZ2003	
	Headphone board assembly	Non supply					
	Transformer board assembly	Non supply					
	Primary board assembly	Non supply					
◎	Audio board assembly	PWZ1936	PWZ1935	PWZ1935	PWZ1936	PWZ2007	
◎	Sub board assembly	PWX1133	PWX1132	PWX1132	PWX1133	PWX1132	
△	Voltage selector (AC110V,120-127V,220V,240V)	• • • •	• • • •	• • • •	• • • •	PSB1002	
△	FU470 Fuse (T160mA)	• • • •	REK-092	REK-092	REK-092	REK-092	

## MAIN BOARD ASSEMBLY

The Main board assembly (PWZ1745) and (PWZ2003) are the same as the Main board assembly (PWZ1751) with the exception of the following sections.

Mark	Symbol & Description	Part No.			Remarks
		PWZ1751	PWZ1745	PWZ2003	
	C903,C904 D903-D906 JA901,JA902 R904 R905	CCCSL101J50 1SS254 RKN1004 RD1/6PM244J RD1/6PM102J	• • • • • • • • • • • • • • • • • • • •	• • • • • • • • • • • • • • • • • • • •	

## HEADPHONE BOARD ASSEMBLY

The Headphone board assembly of SD type is the same as that of KU/CA type with the exception of the following sections. Other types are the same as the KU/CA type for the service supply parts.

Mark	Symbol & Description	Part No.		Remarks
		KU/CA type	SD type	
	IC500	M5218L	M5218AL	

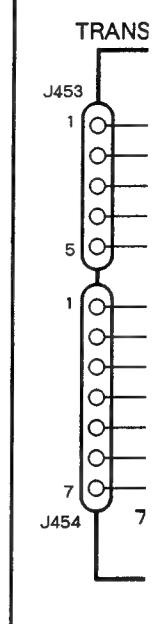
Other P.C. Board Assemblies are the same as the KU/CA type for the service supply parts.

## 10.2 SCI

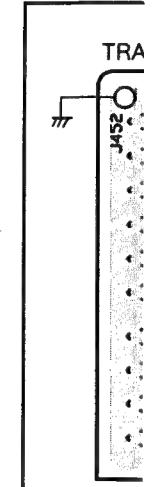
Note: The types

## 10.2.1 FO

## ● SCHEMATIC



## ● P.C. BOARD



## ● LINE VOL

Line voltage  
1. Disconnect  
2. Remove  
3. Change t  
(J450). (

## MAIN BOARD ASSEMBLY

The Main board assembly (PWZ1745) and (PWZ2003) are the same as the Main board assembly (PWZ1751) with the exception of the following sections.

Mark	Symbol & Description	Part No.			Remarks
		PWZ1751	PWZ1745	PWZ2003	
	C903,C904 D903 – D906 JA901,JA902 Remote control jack R904 R905	CCCSL101J50 ISS254 RKN1004 RD1/6PM244J RD1/6PM102J	• . . . . • . . . . • . . . . • . . . . • . . . .	• . . . . • . . . . • . . . . • . . . . • . . . .	

## HEADPHONE BOARD ASSEMBLY

The Headphone board assembly of SD type is the same as that of KU/CA type with the exception of the following sections. Other types are the same as the KU/CA type for the service supply parts.

Mark	Symbol & Description	Part No.		Remarks
		KU/CA type	SD type	
	IC500	M5218L	M5218AL	

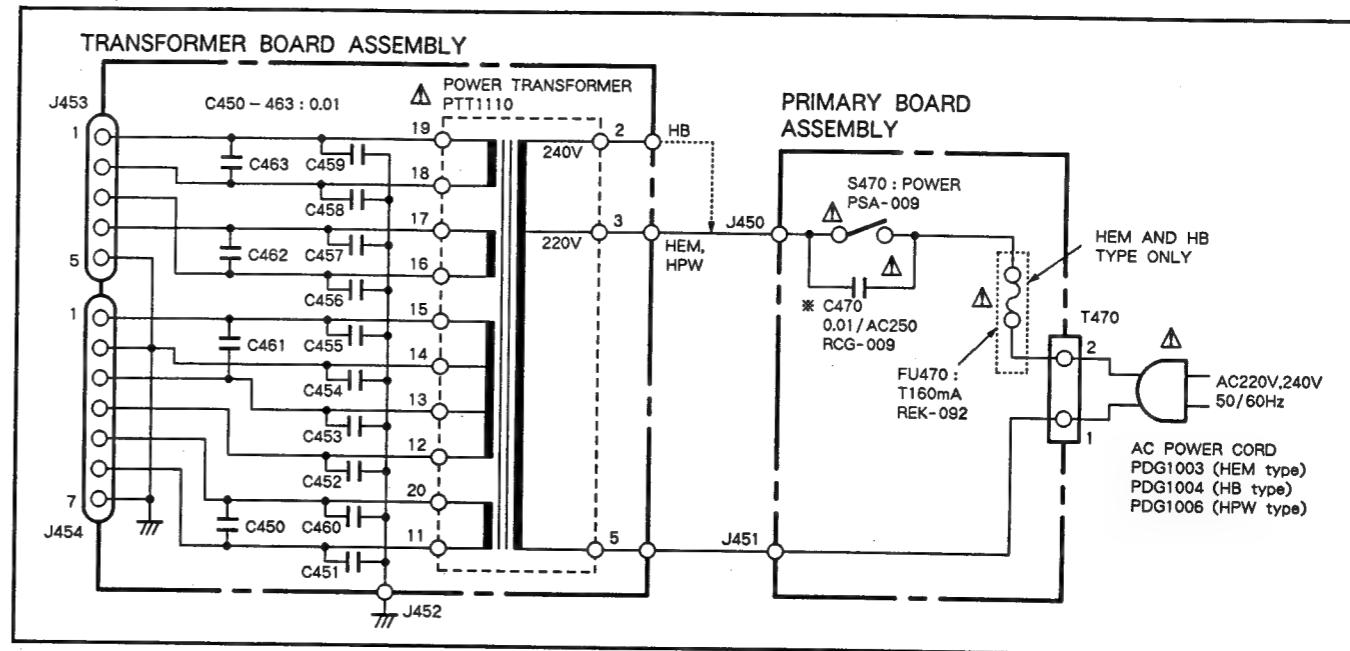
Other P.C. Board Assemblies are the same as the KU/CA type for the service supply parts.

## 10.2 SCHEMATIC DIAGRAM AND P.C. BOARDS PATTERN

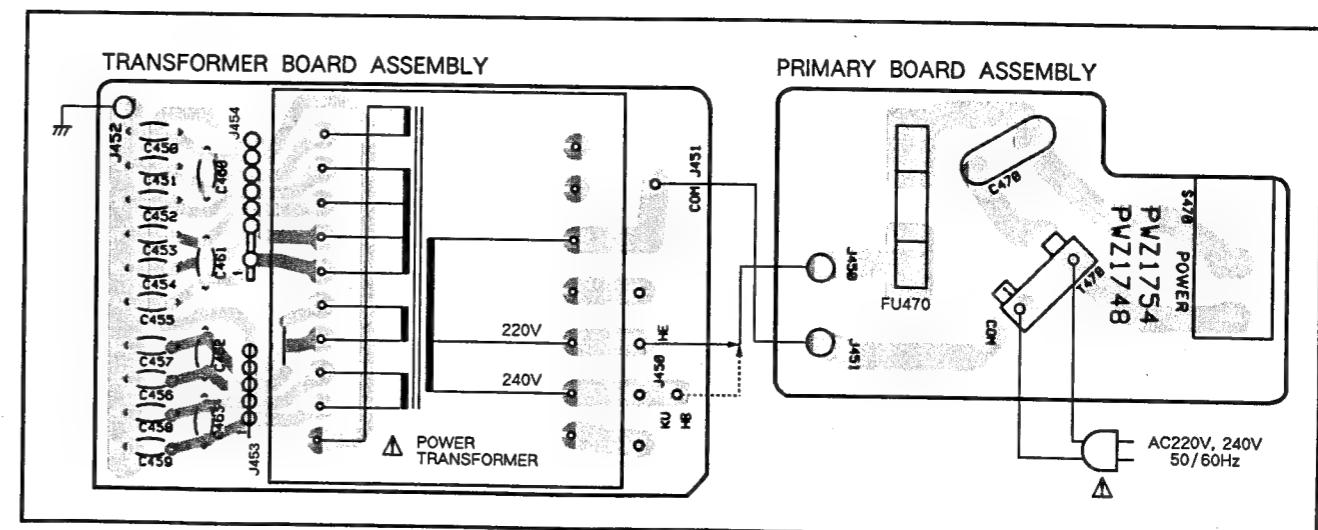
Note: The SCHEMATIC DIAGRAM and the P.C. BOARDS CONNECTION DIAGRAM of the HEM, HB, HPW and SD types are showed in the KU/CA type with the exception of the power supply section. (Pages 15 – 18.)

### 10.2.1 FOR HEM, HB AND HPW TYPES

#### ● SCHEMATIC DIAGRAM



#### ● P.C. BOARDS PATTERN



#### ● Line Voltage Selection

Line voltage can be changed with following steps.

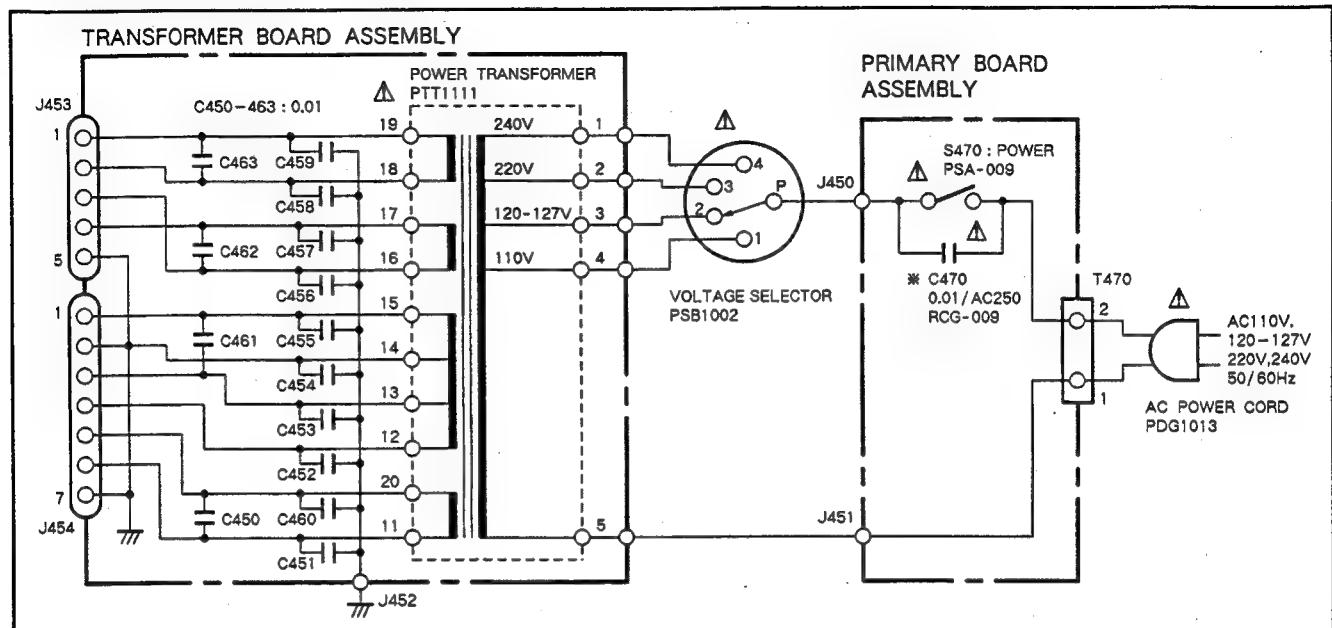
1. Disconnect the AC power cord.
2. Remove the Bonnet case.
3. Change the connection of the primary lead wires (J450). (Connect as shown in schematic diagram)

4. Stick the line voltage label on the rear panel.

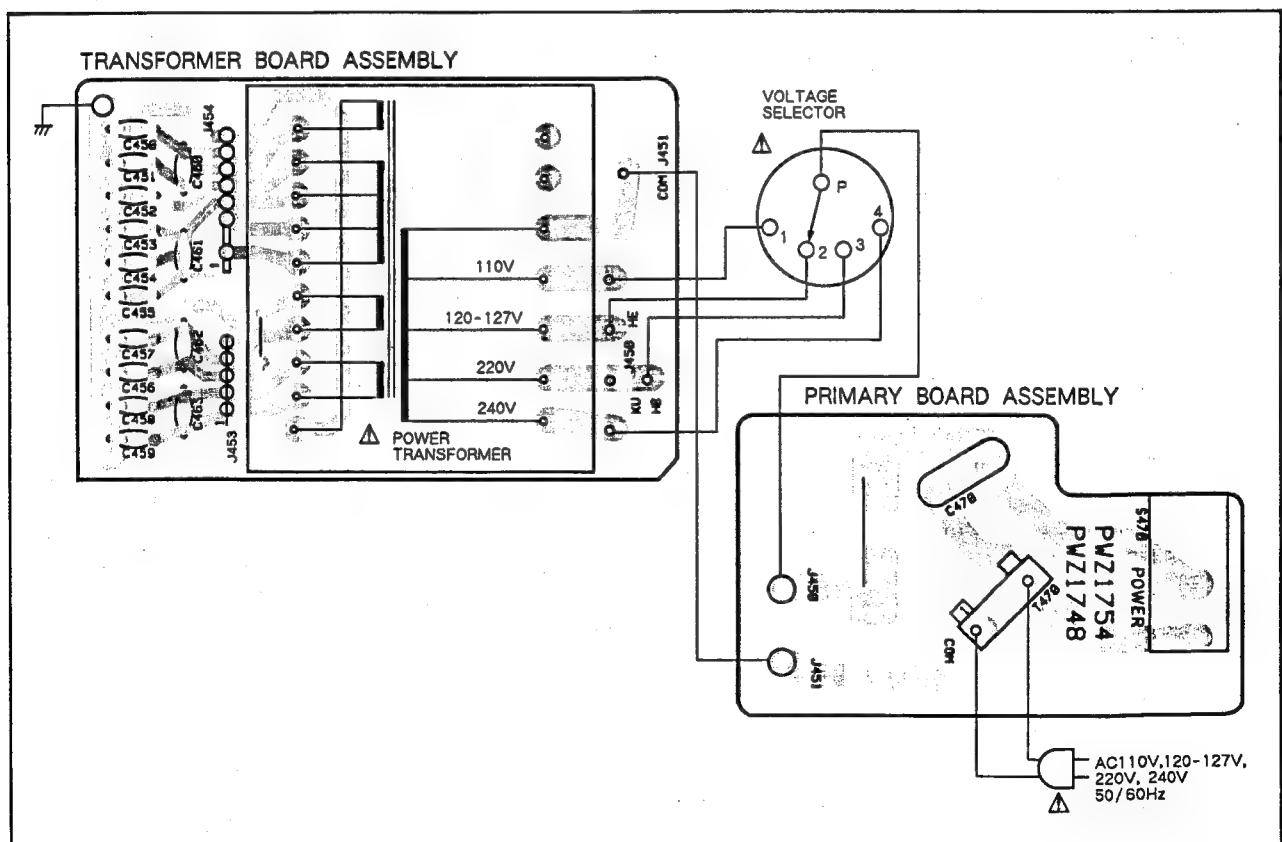
Description	Part No.
220V label	AAX-193
240V label	AAX-192

### 10.2.2 FOR SD TYPE

● SCHEMATIC DIAGRAM



● P. C. BOARDS PATTERN



## 11. SPECIFICATIONS

### 1. General

Type ..... Compact disc digital audio system  
 Usable discs ..... Compact Disc  
 Power requirements  
 U.K. and Australian models ..... AC 240V, 50/60Hz  
 European model ..... AC 220V, 50/60Hz  
 U.S. and Canadian models ..... AC 120V, 60Hz  
 Multi-voltage model ..... AC 110/120-127/220/240V  
 (switchable) 50/60Hz  
 Power consumption ..... 17W  
 Operating temperature ..... +5°C-+35°C  
 (41°F-+95°F)  
 Weight ..... 8.0kg (17lb, 10oz)  
 External dimensions ..... 420(W) x 326(D) x 132(H)mm  
 16-9/16(W) x 12-13/16(D) x 5-3/16(H) in.

### 2. Audio section

Frequency response ..... 2Hz-20kHz  
 S/N ..... 112dB or more (EIAJ)  
 Dynamic range ..... 98dB or more (EIAJ)  
 Channel separation ..... 108dB or more (EIAJ)  
 Total harmonic distortion ..... 0.0019% or less (EIAJ)  
 Output voltage ..... 2.0V  
 Wow and flutter ..... Limit of measurement  
 (±0.001% W.PEAK) or less (EIAJ)  
 Number of channels ..... 2 channels (stereo)

### 3. Output terminal

- Audio line output terminals
- CD-DECK SYNCHRO terminal
- Control input/output terminals  
 (U.S., Canadian and Australian models only)
- Headphone jack (with volume control)
- Optical digital output terminal
- Coaxial digital output terminal

### 4. Functions

- Play
- Pause
- Stop
- Track search
- Manual search
- Index search
- Direct selection
- Single track repeat
- All track repeat
- Programmed repeat
- Random play repeat
- Programmed random play repeat
- Programmed playback (up to 24 tracks)
- Pause program
- Program check
- Program correction
- Program clear
- Auto program edit
- Compu program edit
- Time fade edit (Fade time variable)
- One touch fade (Fade time variable)
- Digital level control
- Random play
- Programmed random play
- Music window

- Time location
- Display off
- Timer start
- CD-deck synchro

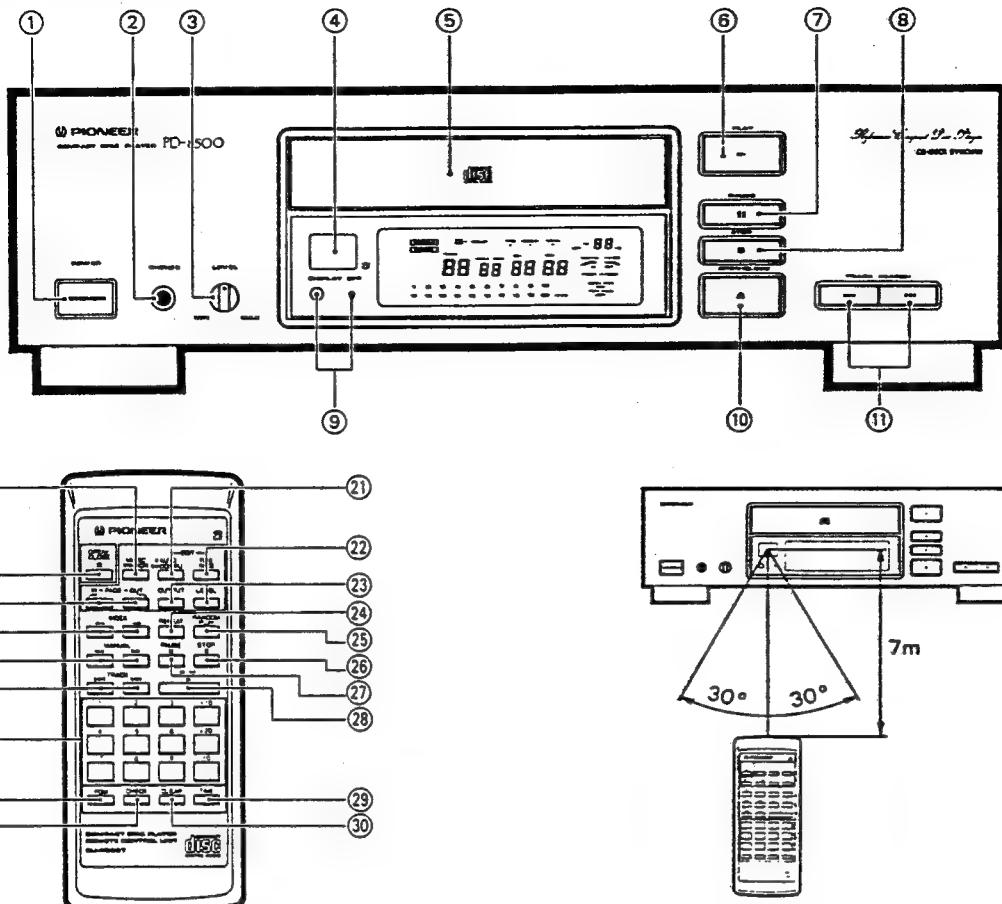
### 5. Accessories

● Remote control unit	1
● Size AAA/R03 dry cell batteries	2
● Output cable	1
● Control cord	1
(U.S., Canadian and Australian models only)	
● Operating instructions	1

### NOTE:

The specifications and design of this product are subject to change without notice, due to improvements.

## 12. PANEL FACILITIES



### FRONT PANEL

#### ① POWER switch

Press to turn power ON and OFF. If the power is turned ON when a disc is already loaded, the player will automatically enter the play mode (timer start function).

#### ② Headphones jack (PHONES)

#### ③ Headphones volume control (PHONES LEVEL)

#### ④ Remote sensor

#### ⑤ Disc tray

#### ⑥ PLAY button/indicator (▷)

#### ⑦ PAUSE button/indicator (□□)

#### ⑧ STOP button (■)

#### ⑨ DISPLAY OFF button/indicator

#### ⑩ OPEN/CLOSE button (△)

#### ⑪ TRACK SEARCH buttons (◀◀, ▶▶)

### NOTE:

If the remote control sensor window is in a position where it receives strong light such as sunlight or fluorescent light, control may not be possible.

#### ⑫ MUSIC WINDOW button

#### ⑬ OPEN/CLOSE button (△)

#### ⑭ FADE IN/OUT buttons (↖, ↗)

#### ⑮ Index search buttons (INDEX ←, →)

#### ⑯ Manual search buttons (MANUAL ◀◀, ▶▶)

#### ⑰ Track search buttons (TRACK ◀◀, ▶▶)

#### ⑱ Track number buttons (1-10, +10, ≥20)

#### ⑲ Program button (PGM)

#### ⑳ CHECK button

#### ㉑ Program edit button (EDIT)

#### (■ AUTO/■■ COMPU)

#### ㉒ TIME FADE EDIT button

#### ㉓ OUTPUT LEVEL buttons (-, +)

#### ㉔ REPEAT button

#### ㉕ RANDOM PLAY button

#### ㉖ STOP button (■)

#### ㉗ PAUSE button (■■)

#### ㉘ PLAY button (▷)

#### ㉙ TIME button

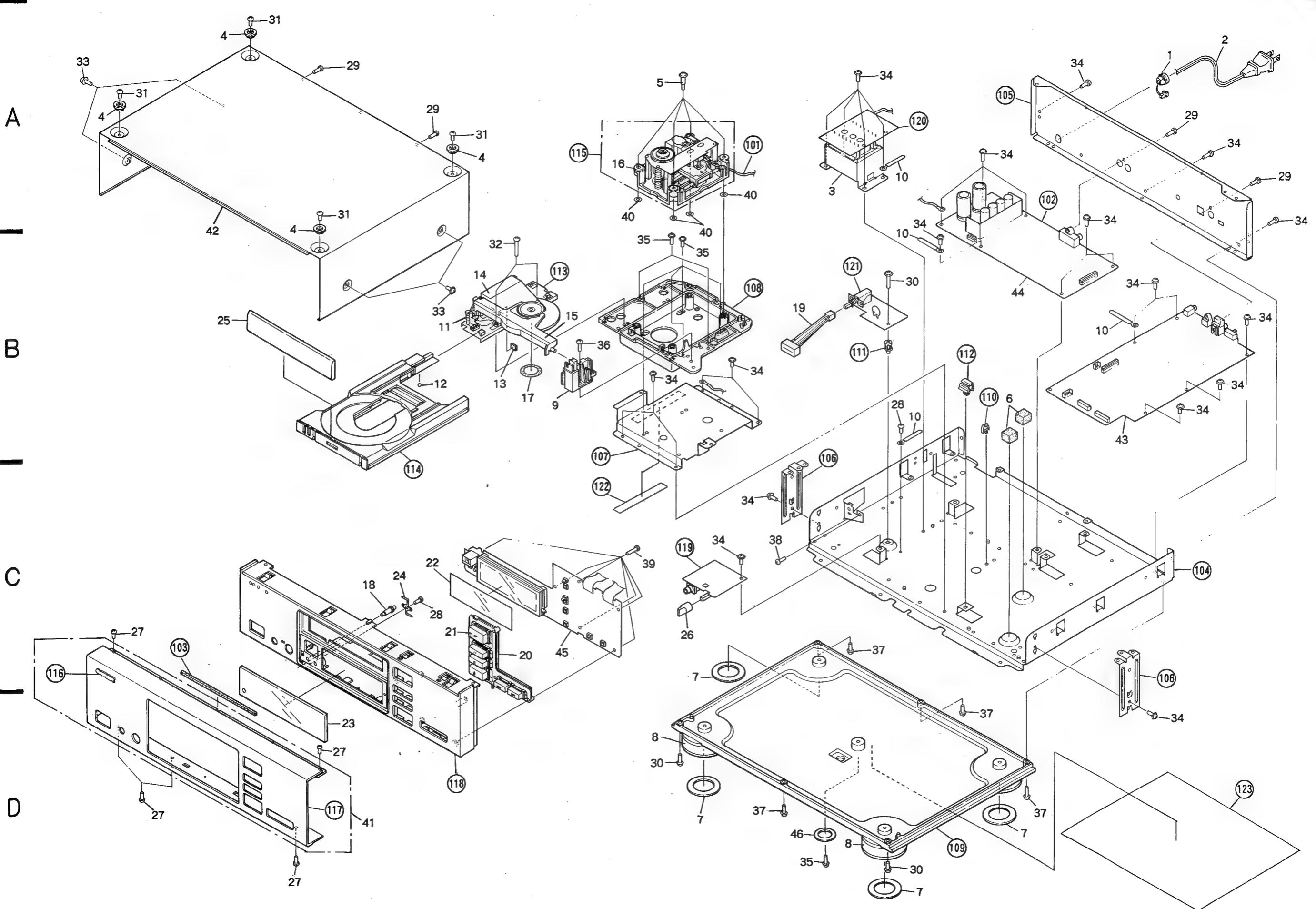
#### ㉚ CLEAR button

### REMOTE CONTROL UNIT

Buttons listed here but not accompanied with explanations have the same functions as the corresponding front-panel buttons. If use is made of the supplied remote control unit, remote operation is possible.

To use the remote control unit, aim at the remote sensor.

The remote control unit can operate over a range of approximately 23 feet (7 meters), within angles of 30 degrees left and right.



1

2

3

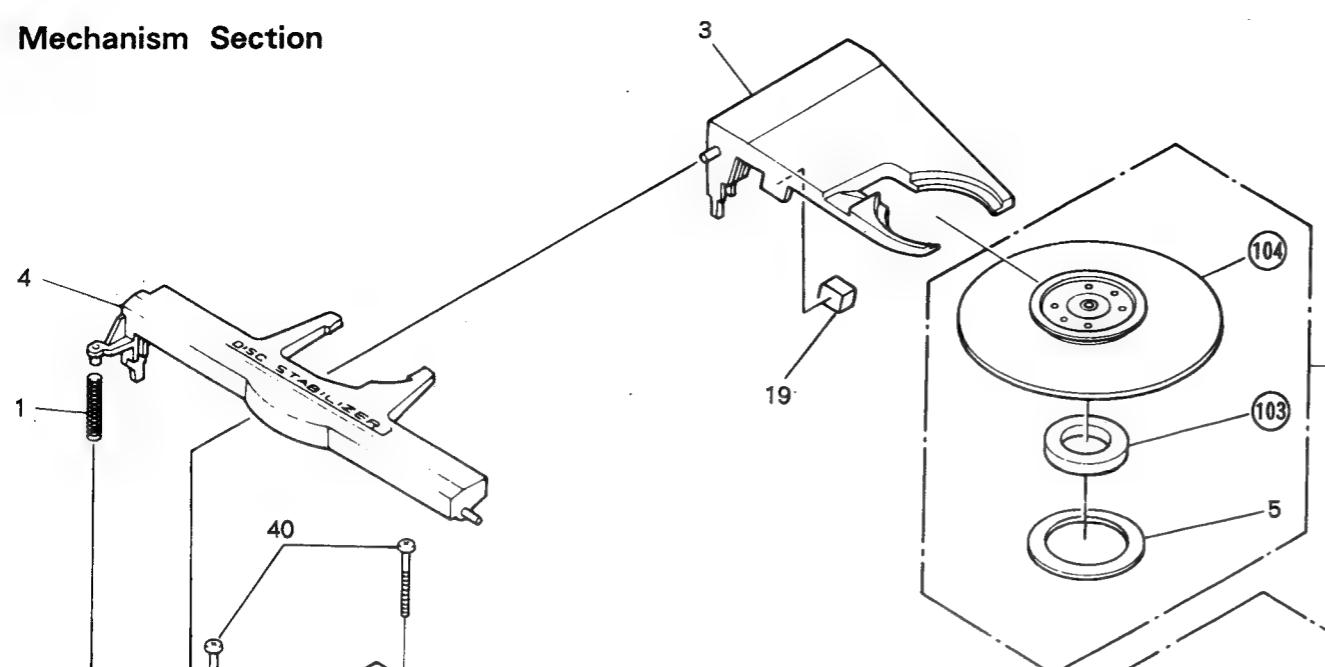
4

5

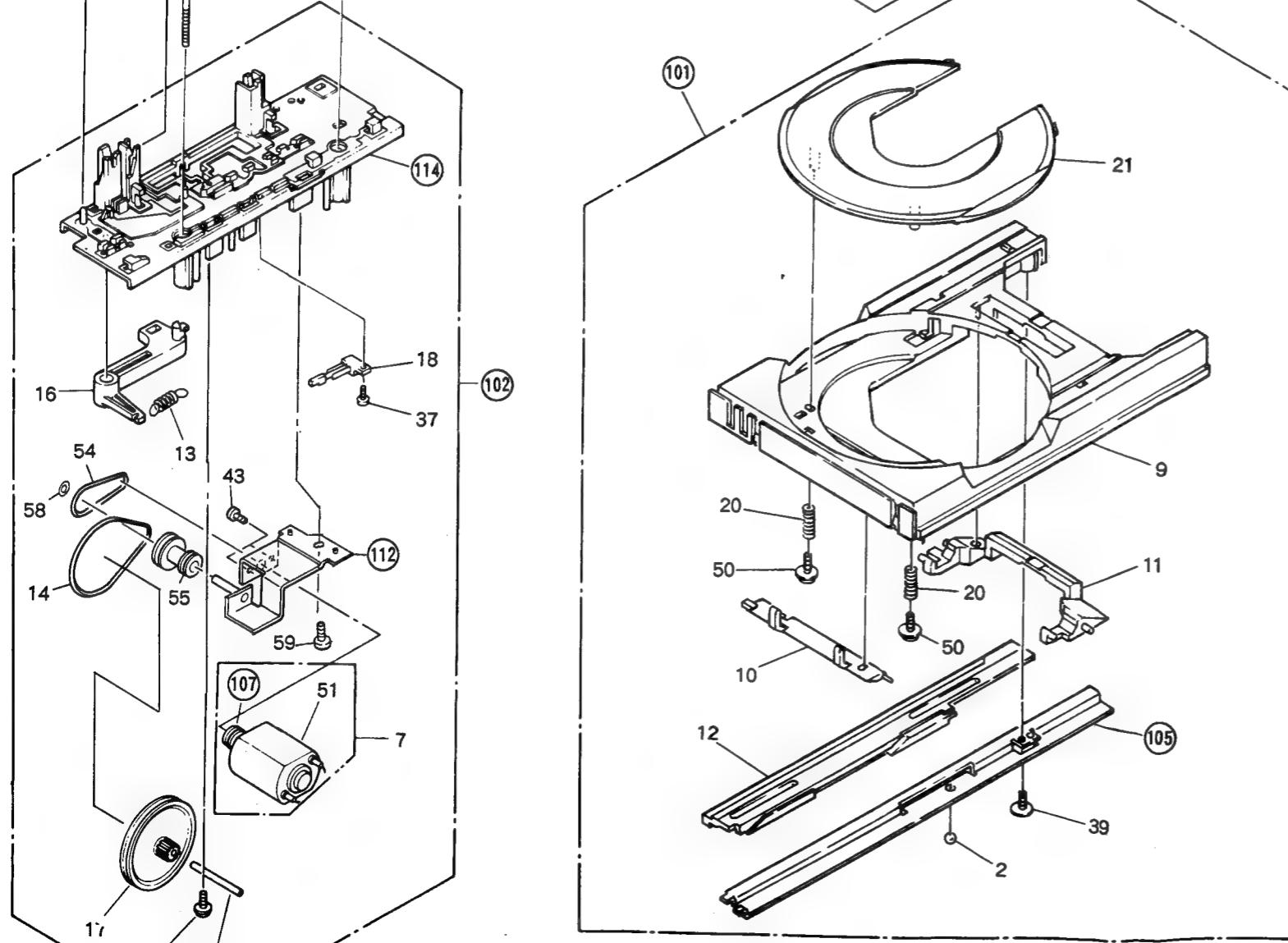
6

## 2.2 Mechanism Section

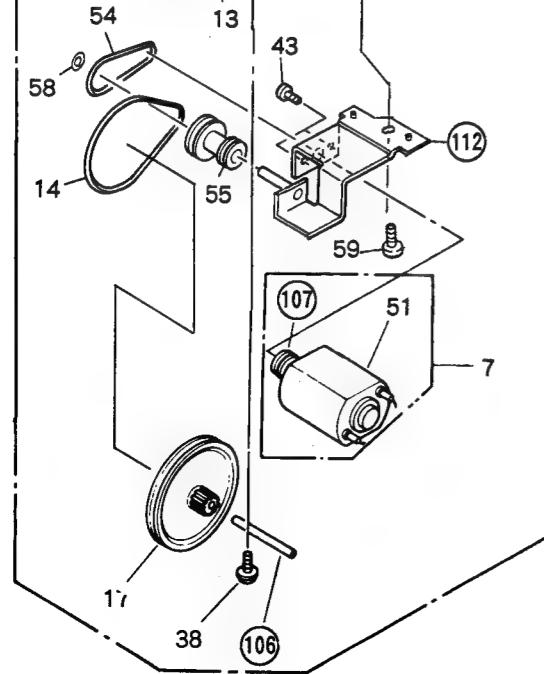
A



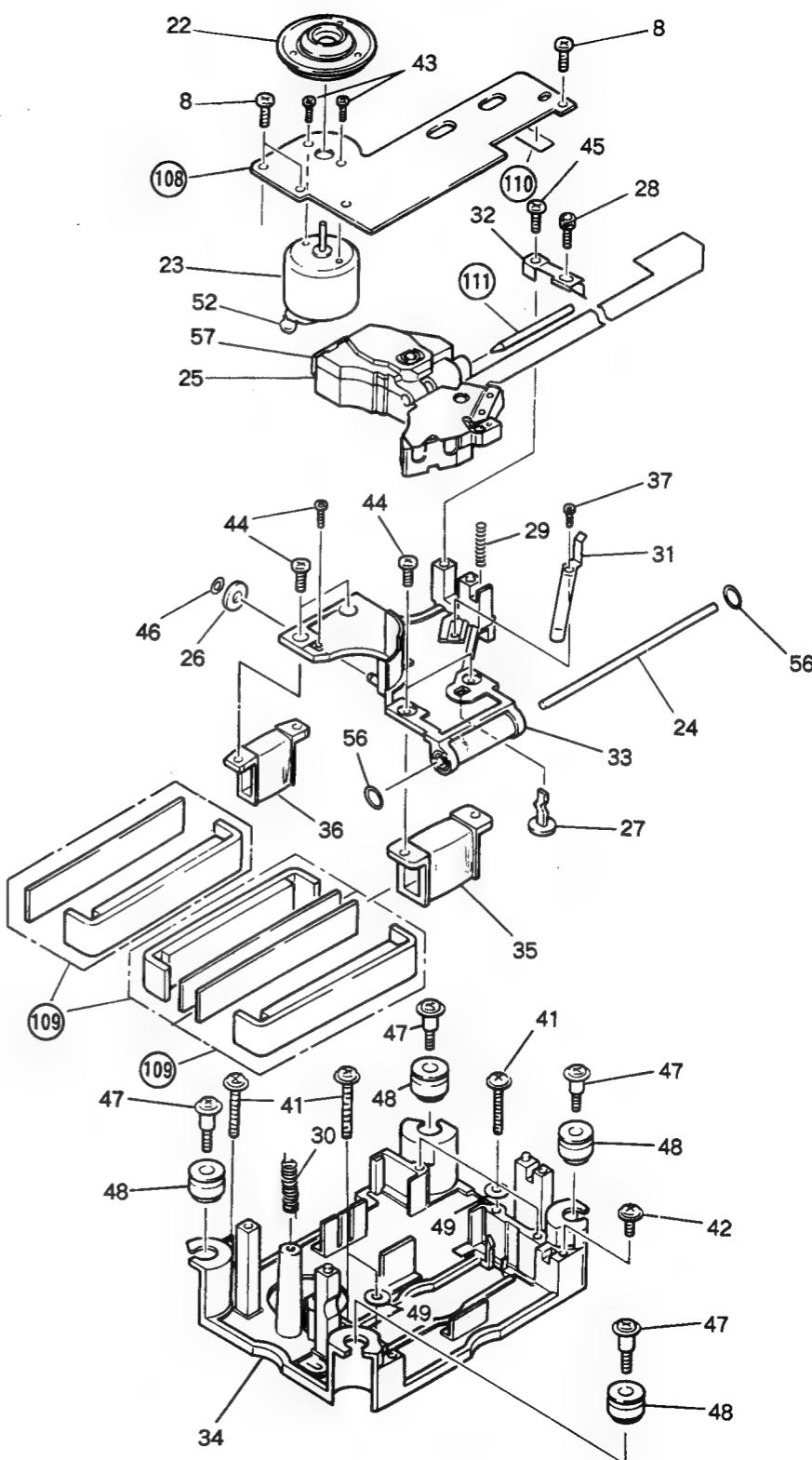
B



C



D



A

B

C

D

7

1

2

3

4

5

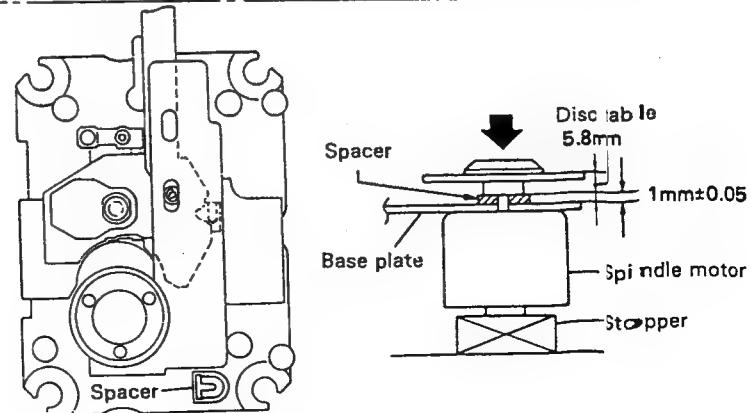
6

## Parts List of Mechanism Section

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
1	PBH1013	Spring		40	BPZ30P250FMC	Screw	
2	PBP-001	Steel ball $\phi$ 4		41	IBZ30P180FMC	Screw	
3	PNW1084	Clamp holder		42	IPZ30P080FMC	Screw	
4	PNW1085	Clamp retainer		43	PMZ20P030FMC	Screw	
5	PNM1010	Disc cushion		44	PMZ26P040FMC	Screw	
6	PYY1084	Clamper assembly		45	PPZ26P080FMC	Screw	
7	PYY1025	Motor assembly (LOADING)		46	WT25D047D025	Washer	
8	PBA1031	Screw (2 x 8)		47	PBA1027	Floating screw	
9	PNW1830	Tray		48	PEB1031	Floating rubber	
10	PNW1330	Plate lever (F)		49	WA32F100M050	Washer	
11	PNW1331	Plate lever (R)		50	PBA1025	Screw	
12	PNW1332	Rack		51	PXM1002	Motor (LOADING)	
13	PBH1012	Clamp spring		52	CKDYF103Z50	Ceramic capacitor	
14	PEB1013	Belt (loading)		53		• • • •	
15		• • • •		54	PEB1125	Belt	
16	PNW1083	Clamp lever		55	PNW1594	2 steps pulley	
17	PNW1171	Gear pulley		56	PEB1097	Rubber ring	
18	VSK-015	Leaf switch (CLAMP : S102)		57	PNB1232	Weight	
19	PEB1032	Stopper rubber		58	WT26D047D050	Washer	
20	PBH1045	Plate spring		59	PDZ30P050FMC	Screw	
21	PNW1829	Disc plate		101		Tray assembly	
22	PNW1064	Disc table		102		Loading base assembly	
23	PEA1086	Motor assembly (Spindle with oil)		103		Clamp magnet	
24	PLA1061	Guide bar		104		Clamper	
25	PWY1011	Pickup assembly		105		Slide base	
26	PNW1408	Roller		106			
27	PNW1407	Adjustment shaft		107		Gear shaft	
28	PBA1026	Adjustment screw		108		Motor pulley	
29	PBH1029	Shaft spring		109		Base plate	
30	PBH1068	Earth spring		110		Yoke unit	
31	PBK1045	Plate spring T		111		Felt	
32	PBK1046	Plate spring R		112		PU guide bar	
33	PNW1405	Carriage		113		Pulley angle	
34	PNW1406	Mechanism chassis		114		• • • •	
35	PXP1003	Drive unit				Loading base	
36	PXP1004	Detector unit					
37	BPZ20P080FZK	Screw					
38	IBZ30P050FZK	Screw					
39	PPZ30P080FMC	Screw					

### • Mounting of disc table

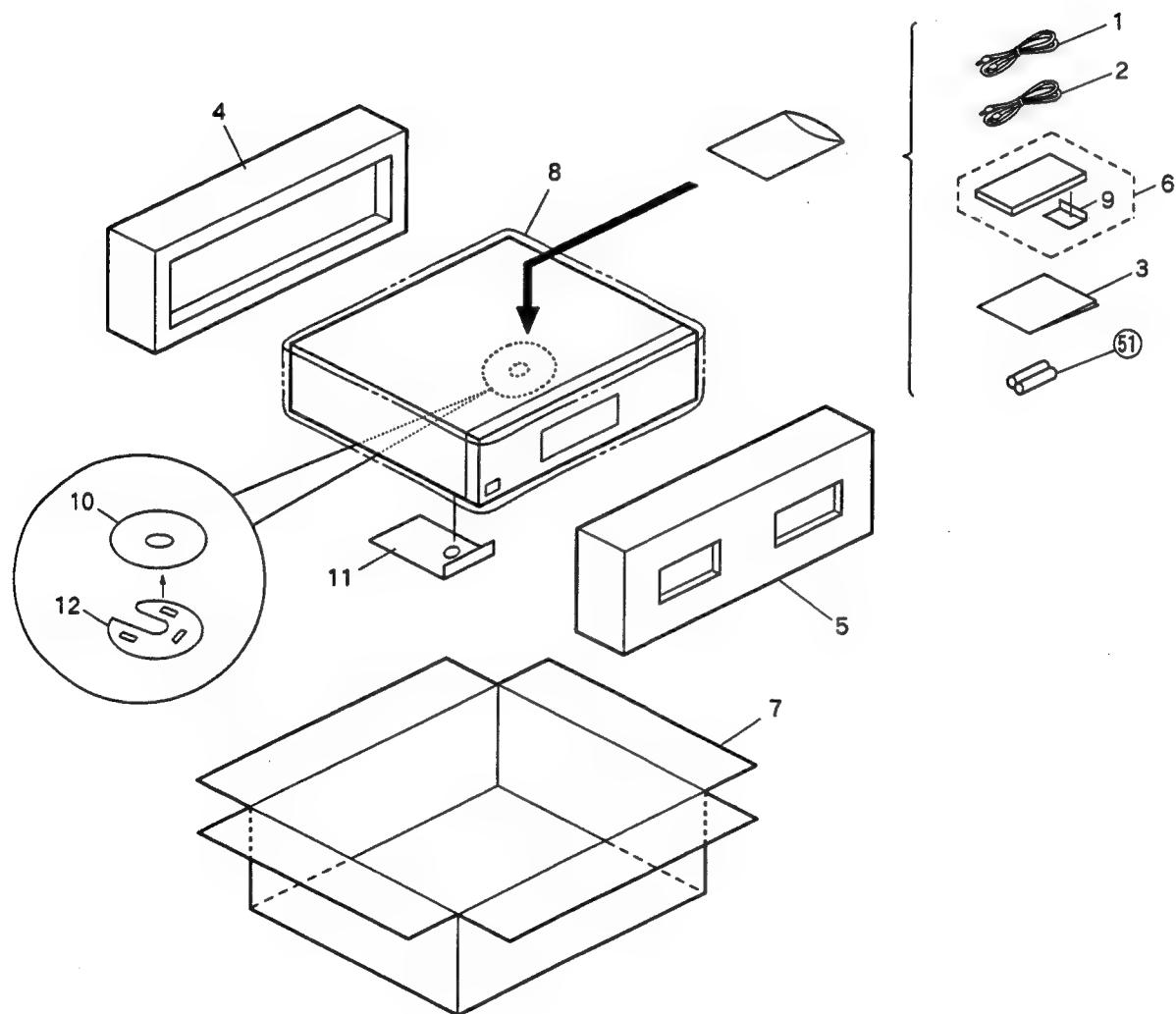
When pushing the disc table in, a stopper must be placed (with a pressure of approx. 9kg) on the bottom of the spindle motor. Insert the spacer (cut from the mechanism chassis) between the base plates and disc table as shown in the Figure below.



## PACKING

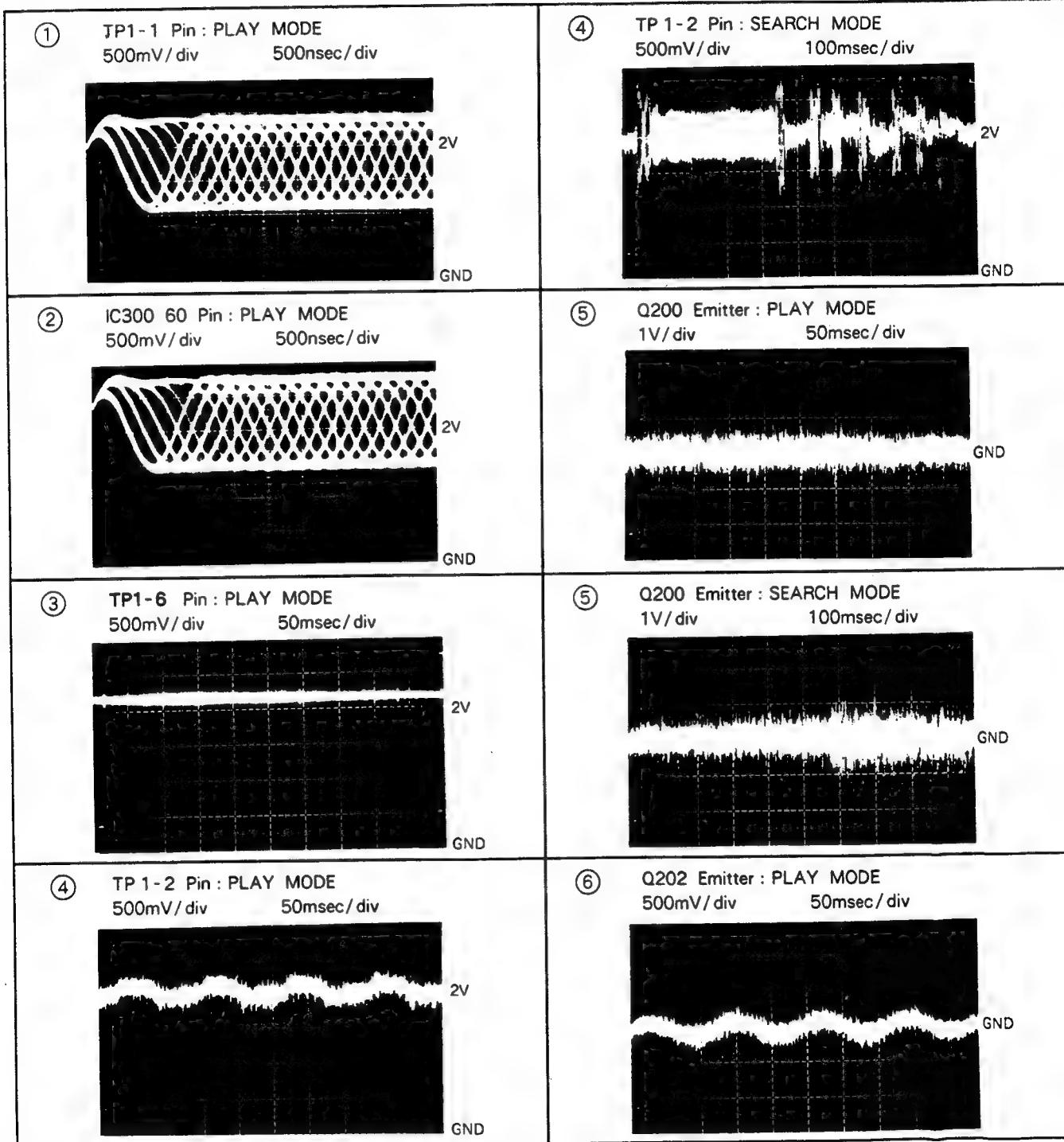
## Parts List

Mark	No.	Part No.	Description
1	PDE-319		Connection cord with mini plug
2	PDE1001		Cord with pin plug
3	PRB1130		Operating instructions (English)
4	PHA1137		Protector R
5	PHA1136		Protector F
6	PWW1044		Remote control unit
7	PHG1526		CD packing case
8	VHL-037		Sheet
9	PZN1001		Battery cover
10	PHC1030		Spacer (into the tray)
11	PRM1016		Caution card
12	PHC1022		Sheet
	51		Battery

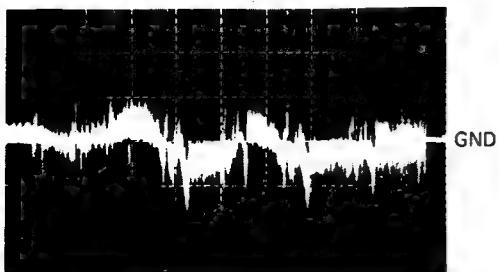


## WAVE FORMS

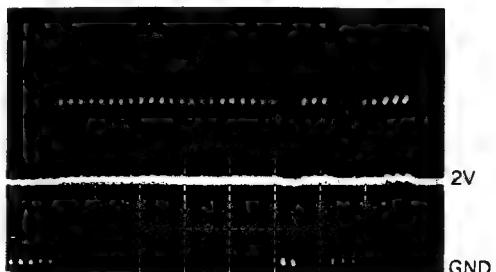
NOTE : The encircled numbers denote measuring points in the schematic diagram.



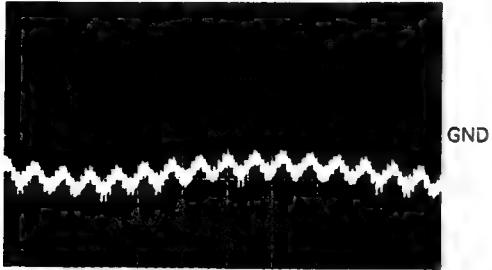
⑥ Q202 Emitter : SEARCH MODE  
500mV/div 50msec/div



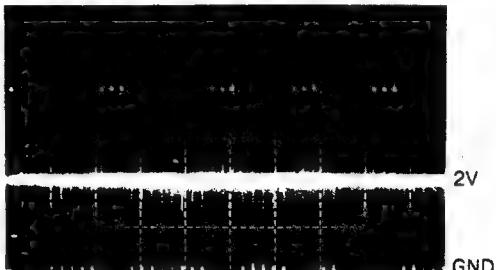
⑨ IC100-50 Pin : PLAY MODE  
1V/div 50μ sec/div



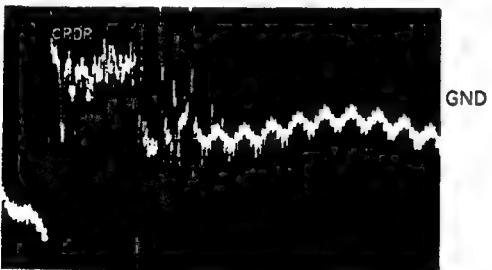
⑦ Q206 Emitter : PLAY MODE  
500mV/div 200msec/div



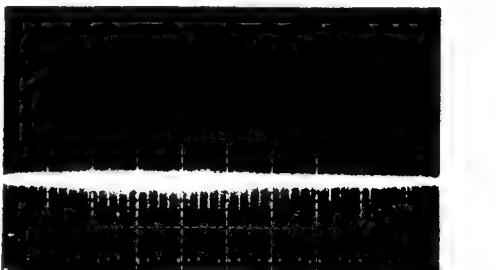
⑩ IC100-48 Pin : PLAY MODE  
1V/div 50μ sec/div



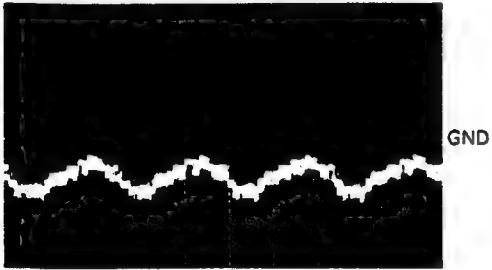
⑦ Q206 Emitter : SEARCH MODE  
500mV/div 200msec/div



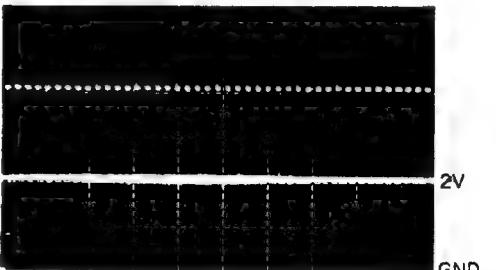
⑪ IC100-46 Pin : PLAY MODE  
1V/div 50μ sec/div



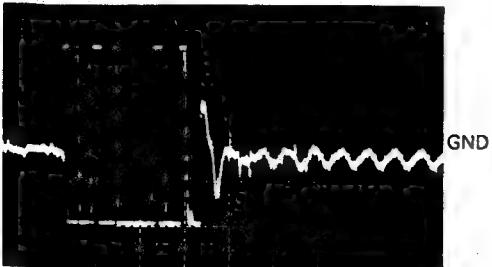
⑧ Q204 Emitter : PLAY MODE  
1V/div 50msec/div



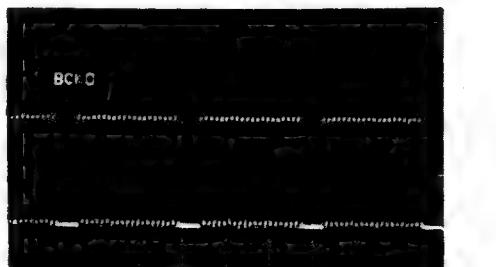
⑫ IC100-44 Pin : PLAY MODE  
1V/div 50μ sec/div

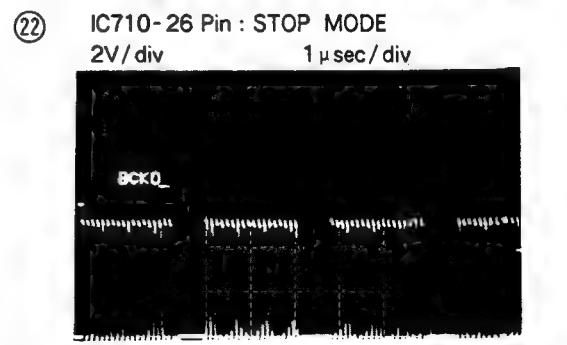
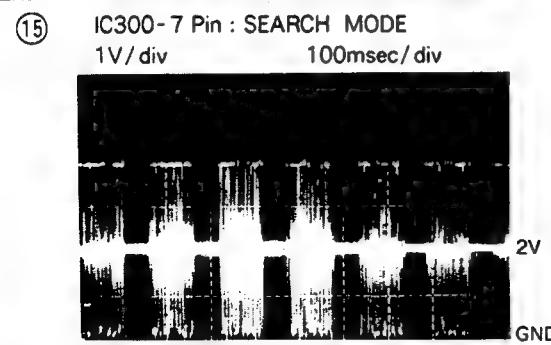
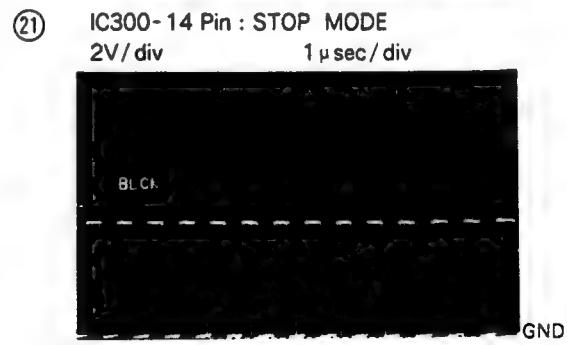
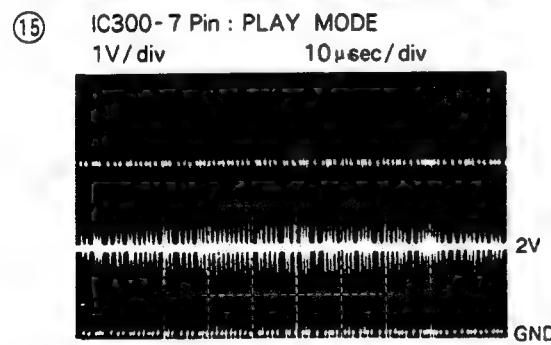
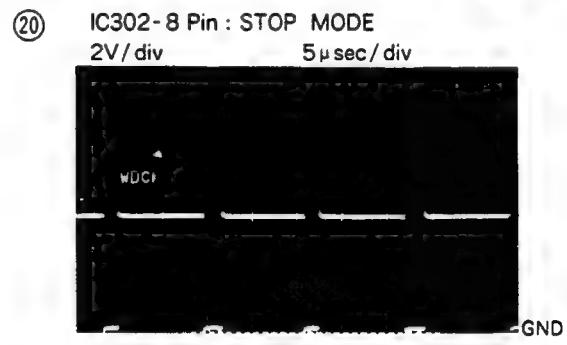
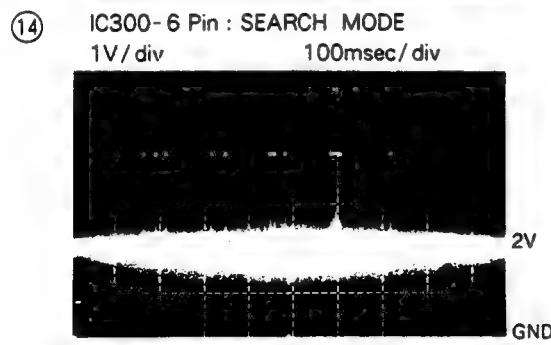
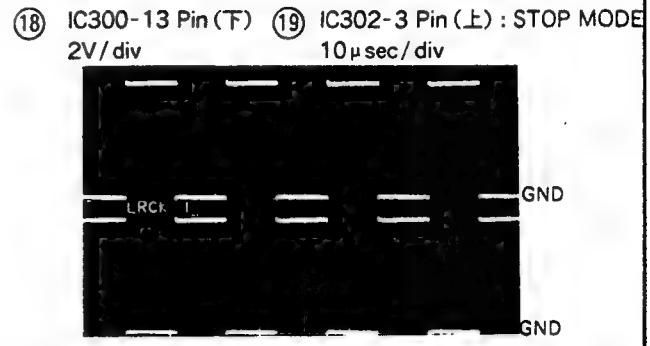
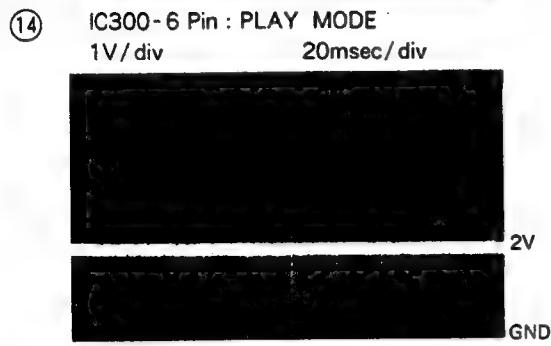
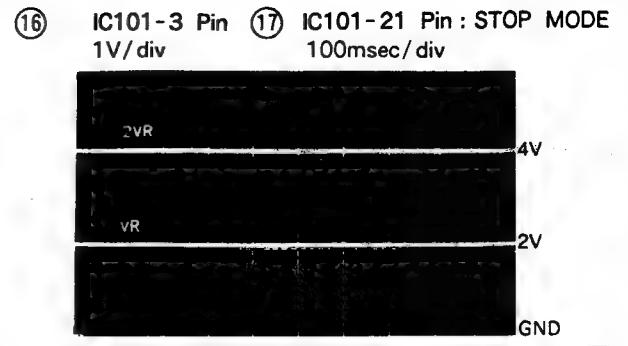
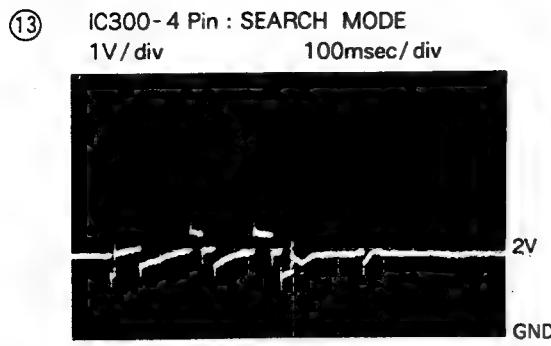


⑧ Q204 Emitter : SEARCH MODE  
2V/div 200msec/div

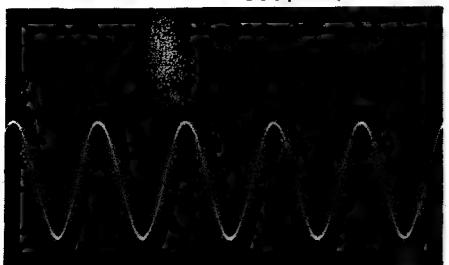


⑬ IC300-4 Pin : PLAY MODE  
1V/div 50msec/div

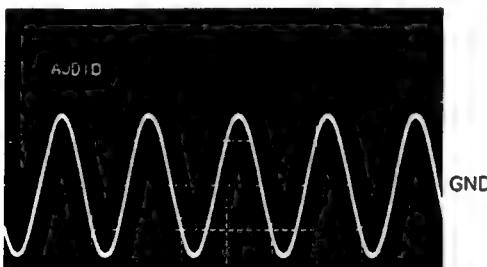




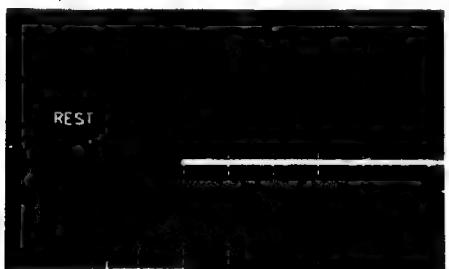
(23) IC750-1 Pin : PLAY MODE  
5V/div 500  $\mu$ sec/div



(24) OUTPUT Lch : PLAY MODE  
2V/div 500msec/div



(25) IC408-5 Pin : POWER ON  
2V/div 100msec/div



(25) IC408-5 Pin : POWER OFF  
2V/div 100msec/div



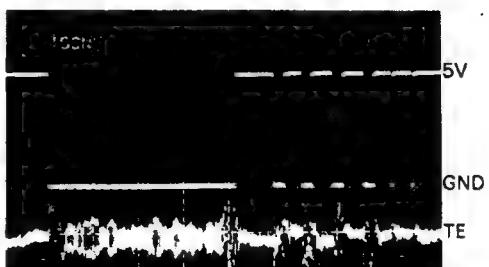
(26) IC300-16 Pin : DOUT PLAY MODE  
2V/div 0.2  $\mu$ sec/div



(27) IC100-41 Pin : PLAY MODE  
2V/div 100msec/div



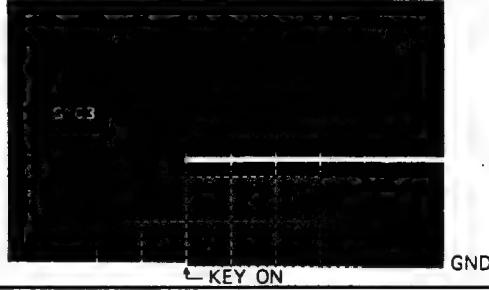
(27) IC100-41 Pin : SEARCH MODE  
2V/div 100msec/div



(28) IC100-38 Pin : PLAY MODE  
2V/div 100msec/div



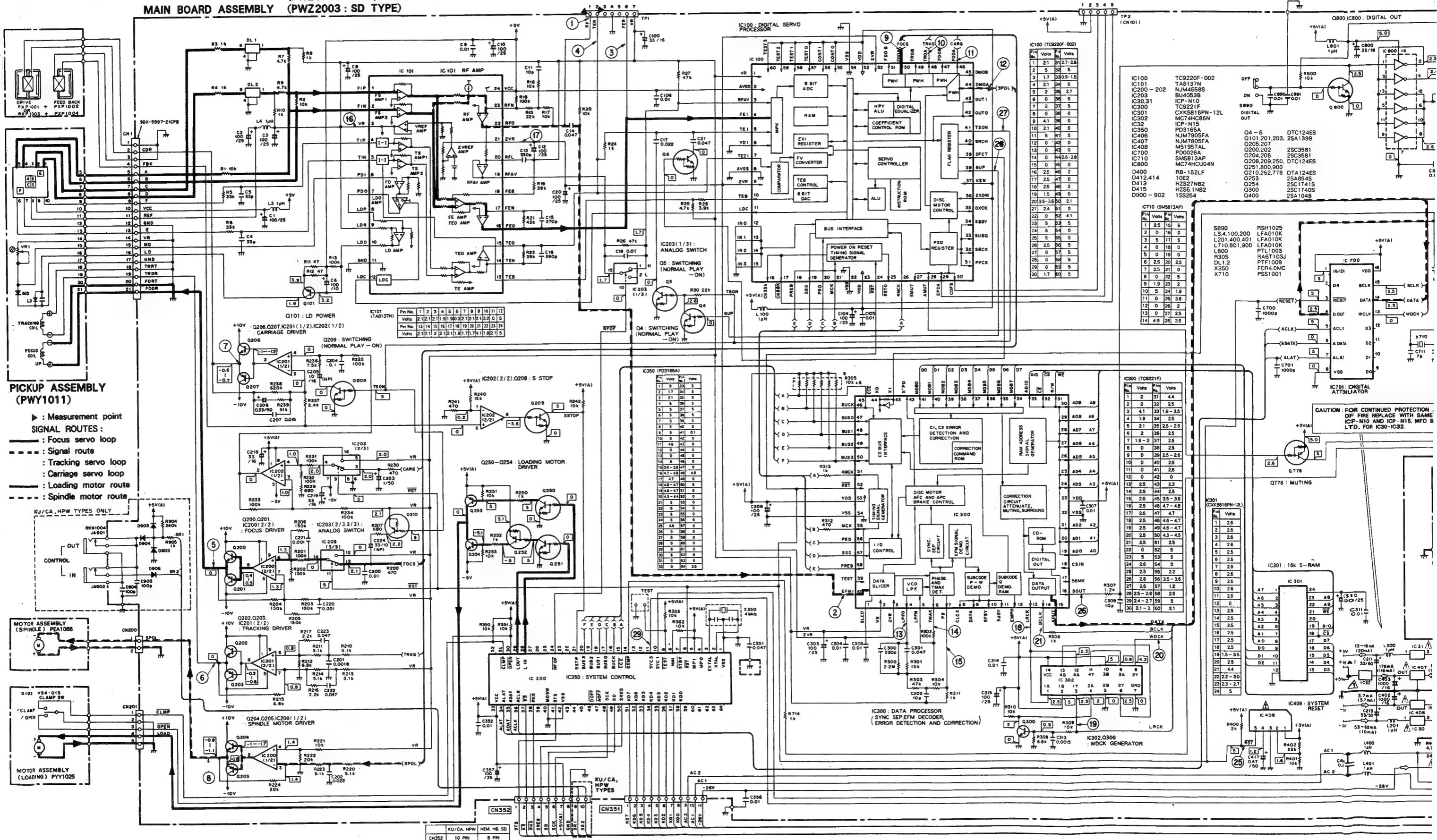
(29) IC350-11 Pin : PLAY KEY ON  
2V/div 100msec/div



## SCHEMATIC DIAGRAM

(PWZ1751 : KU/CA, HPW TYPES)  
 (PWZ1745 : HEM, HB TYPES)  
 (PWZ2003 : SD TYPE)

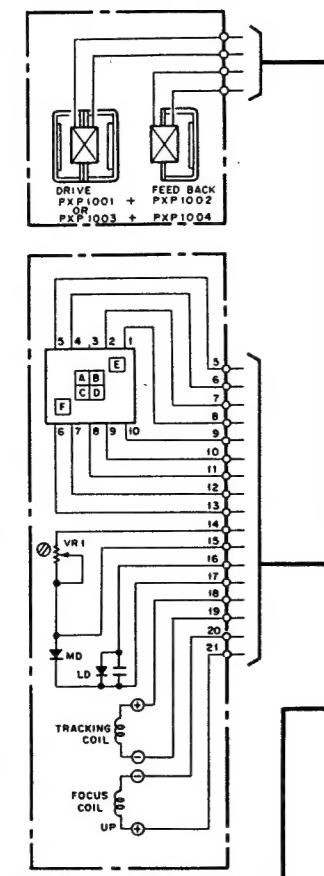
## MAIN BOARD ASSEMBLY





1

## P.C.BOARDS CONNECTION DIAGRAM



- This P.C.B. connection diagram is viewed from the parts mounted side.
- The parts which have been mounted on the board can be replaced with those shown with the corresponding wiring symbols listed in the above Table.
- The capacitor terminal marked with  $\square$  shows negative terminal.
- The diode marked with  $\square$  shows cathode side.
- The transistor terminal marked with  $\square$  shows emitter.

5. The transistor terminal marked with  $\square$  shows emitter.

6. The diode marked with  $\square$  shows cathode side.

7. The capacitor terminal marked with  $\square$  shows negative terminal.

8. The transistor terminal marked with  $\square$  shows emitter.

9. The diode marked with  $\square$  shows cathode side.

10. The capacitor terminal marked with  $\square$  shows negative terminal.

11. The diode marked with  $\square$  shows cathode side.

12. The capacitor terminal marked with  $\square$  shows negative terminal.

13. The diode marked with  $\square$  shows cathode side.

14. The capacitor terminal marked with  $\square$  shows negative terminal.

15. The diode marked with  $\square$  shows cathode side.

16. The capacitor terminal marked with  $\square$  shows negative terminal.

17. The diode marked with  $\square$  shows cathode side.

18. The capacitor terminal marked with  $\square$  shows negative terminal.

19. The diode marked with  $\square$  shows cathode side.

20. The capacitor terminal marked with  $\square$  shows negative terminal.

21. The diode marked with  $\square$  shows cathode side.

22. The capacitor terminal marked with  $\square$  shows negative terminal.

23. The diode marked with  $\square$  shows cathode side.

24. The capacitor terminal marked with  $\square$  shows negative terminal.

25. The diode marked with  $\square$  shows cathode side.

26. The capacitor terminal marked with  $\square$  shows negative terminal.

27. The diode marked with  $\square$  shows cathode side.

2

## P.C.B. CONNECTION DIAGRAM

P.C.B. pattern diagram indication	Corresponding part symbol	Part name	P.C.B. pattern diagram indication	Corresponding part symbol	Part name
		Transistor			Ceramic capacitor
		FET			Mylar capacitor
		Diode			Styrol capacitor
		Zener diode			Electrolytic capacitor (Non polarized)
		LED			Electrolytic capacitor (Noiseless)
		Varactor			Electrolytic capacitor (Polarized)
		Resistor array			Power capacitor
		Resistor			Semi-fixed resistor
		Inductor			Resonator
		Coll			Transformer
		Filter			

## P.C.B. CONNECTION DIAGRAM

3

4

## P.C.B. CONNECTION DIAGRAM

5

## P.C.B. CONNECTION DIAGRAM

6

## P.C.B. CONNECTION DIAGRAM

7

## P.C.B. CONNECTION DIAGRAM

8

## P.C.B. CONNECTION DIAGRAM

9

## P.C.B. CONNECTION DIAGRAM

10

## P.C.B. CONNECTION DIAGRAM

11

## P.C.B. CONNECTION DIAGRAM

12

## P.C.B. CONNECTION DIAGRAM

13

## P.C.B. CONNECTION DIAGRAM

14

## P.C.B. CONNECTION DIAGRAM

15

## P.C.B. CONNECTION DIAGRAM

16

## P.C.B. CONNECTION DIAGRAM

17

## P.C.B. CONNECTION DIAGRAM

18

## P.C.B. CONNECTION DIAGRAM

19

## P.C.B. CONNECTION DIAGRAM

20

## P.C.B. CONNECTION DIAGRAM

21

## P.C.B. CONNECTION DIAGRAM

22

## P.C.B. CONNECTION DIAGRAM

23

## P.C.B. CONNECTION DIAGRAM

24

## P.C.B. CONNECTION DIAGRAM

25

## P.C.B. CONNECTION DIAGRAM

26

## P.C.B. CONNECTION DIAGRAM

27

## P.C.B. CONNECTION DIAGRAM

28

## P.C.B. CONNECTION DIAGRAM

29

## P.C.B. CONNECTION DIAGRAM

30

## P.C.B. CONNECTION DIAGRAM

31

## P.C.B. CONNECTION DIAGRAM

32

## P.C.B. CONNECTION DIAGRAM

33

## P.C.B. CONNECTION DIAGRAM

34

## P.C.B. CONNECTION DIAGRAM

35

## P.C.B. CONNECTION DIAGRAM

36

## P.C.B. CONNECTION DIAGRAM

37

## P.C.B. CONNECTION DIAGRAM

38

## P.C.B. CONNECTION DIAGRAM

39

## P.C.B. CONNECTION DIAGRAM

40

## P.C.B. CONNECTION DIAGRAM

41

## P.C.B. CONNECTION DIAGRAM

42

## P.C.B. CONNECTION DIAGRAM

43

## P.C.B. CONNECTION DIAGRAM

44

## P.C.B. CONNECTION DIAGRAM

45

## P.C.B. CONNECTION DIAGRAM

46

## P.C.B. CONNECTION DIAGRAM

47

## P.C.B. CONNECTION DIAGRAM

48

## P.C.B. CONNECTION DIAGRAM

49

## P.C.B. CONNECTION DIAGRAM

50

## P.C.B. CONNECTION DIAGRAM

51

## P.C.B. CONNECTION DIAGRAM

52

## P.C.B. CONNECTION DIAGRAM

53

## P.C.B. CONNECTION DIAGRAM

54

## P.C.B. CONNECTION DIAGRAM

55

## P.C.B. CONNECTION DIAGRAM

56

## P.C.B. CONNECTION DIAGRAM

57

## P.C.B. CONNECTION DIAGRAM

58

## P.C.B. CONNECTION DIAGRAM

59

## P.C.B. CONNECTION DIAGRAM

60

## P.C.B. CONNECTION DIAGRAM

61

## P.C.B. CONNECTION DIAGRAM

62

## P.C.B. CONNECTION DIAGRAM

63

## P.C.B. CONNECTION DIAGRAM

64

## P.C.B. CONNECTION DIAGRAM

65

## P.C.B. CONNECTION DIAGRAM

66

## P.C.B. CONNECTION DIAGRAM

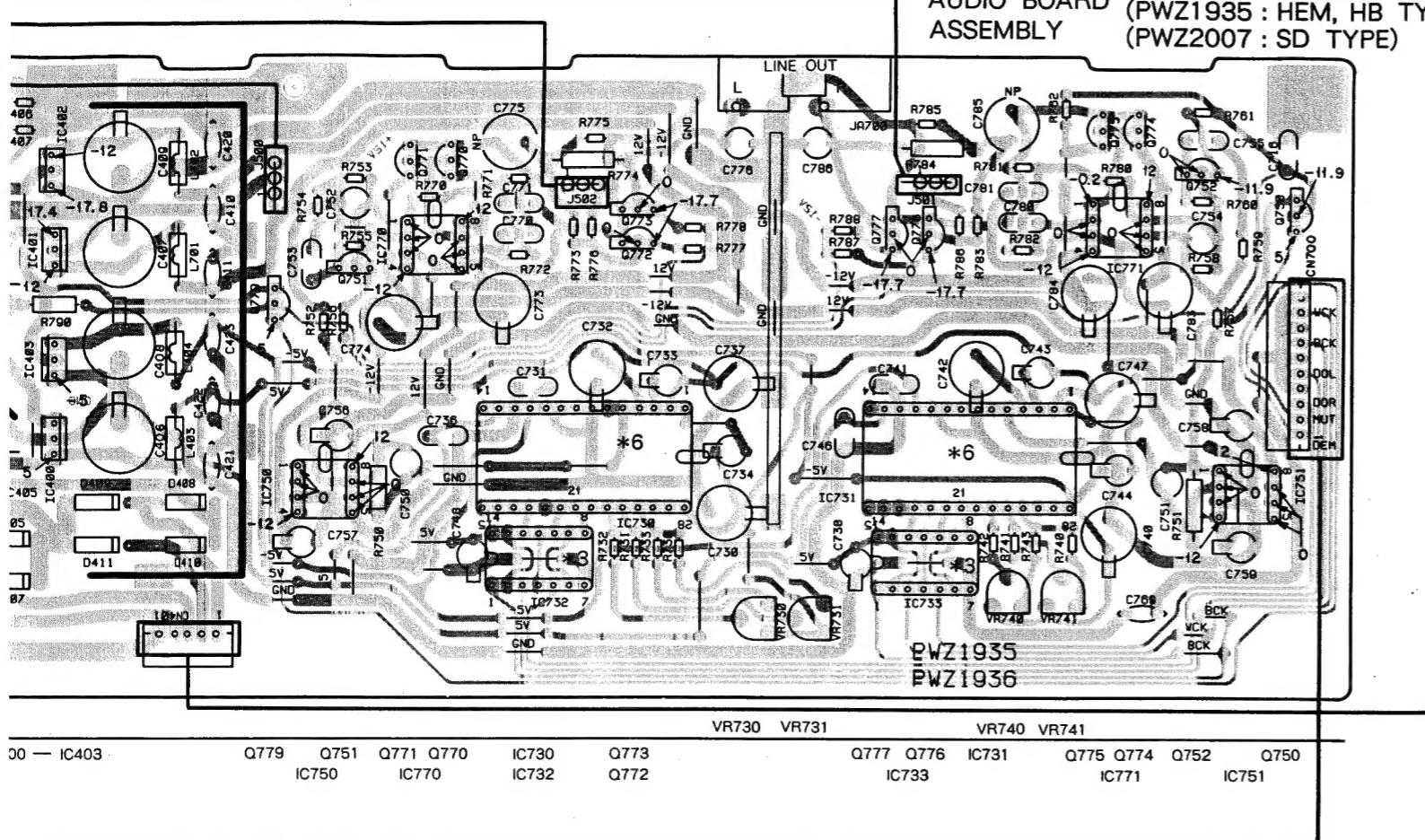
67

## P.C.B. CONNECTION DIAGRAM

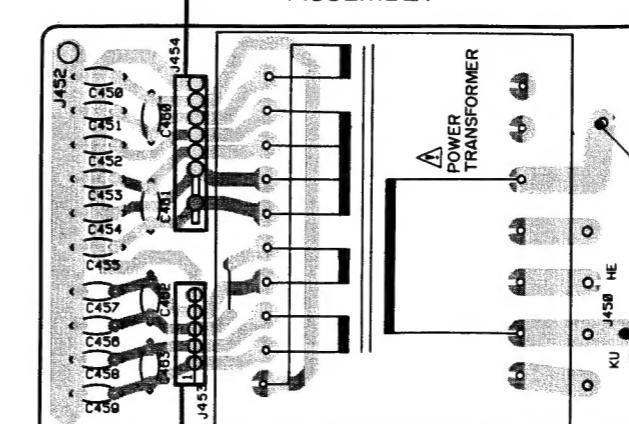
68

## P.C.B. CONNECTION DIAGRAM

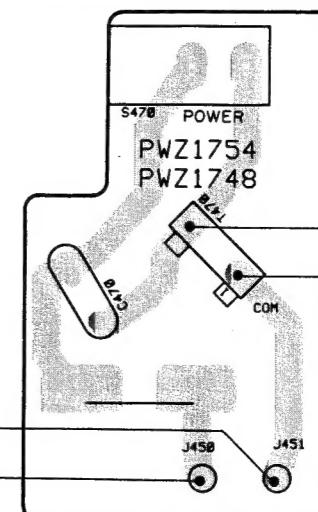
AUDIO BOARD (PWZ1936 : KU/CA, HPW TYPES)  
ASSEMBLY (PWZ1935 : HEM, HB TYPES)  
ASSEMBLY (PWZ2007 : SD TYPE)



## TRANSFORMER BOARD ASSEMBLY



## PRIMARY BOARD ASSEMBLY



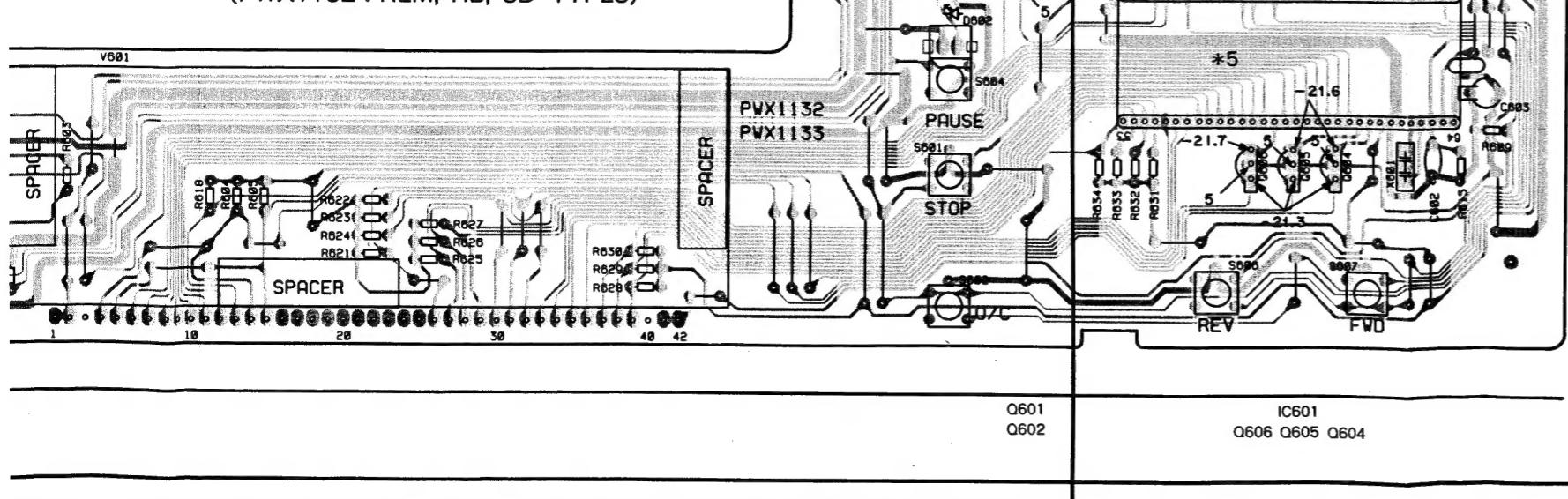
*1		*2	
IC100 (TC9220F-002)		IC300 (TC9221F)	
Pin No.	Volts	Pin No.	Volts
1	2.1	31	2.7-2.8
2	5	32	5
3	1.7	33	0.9-1.5
4	2.1	34	0
5	2	35	2.7
6	0	36	5
7	2	37	5
8	0	38	0
9	4.1	39	0
10	2.1	40	0
11	5	41	5
12	0	42	0
13	0	43	0
14	0	44	2.6-2.8
15	0	45	0
16	2.5	46	2
17	2.5	47	0
18	2.5	48	.2
19	1.5	49	0
20	3.5-3.6	50	2.1
21	2.4	51	0
22	0	52	4.1
23	5	53	5
24	5	54	0
25	5	55	5
26	2.5	56	5
27	0	57	5
28	0	58	5
29	0	59	5
30	1.7	60	5

\*3  
IC732,  
(MC74)

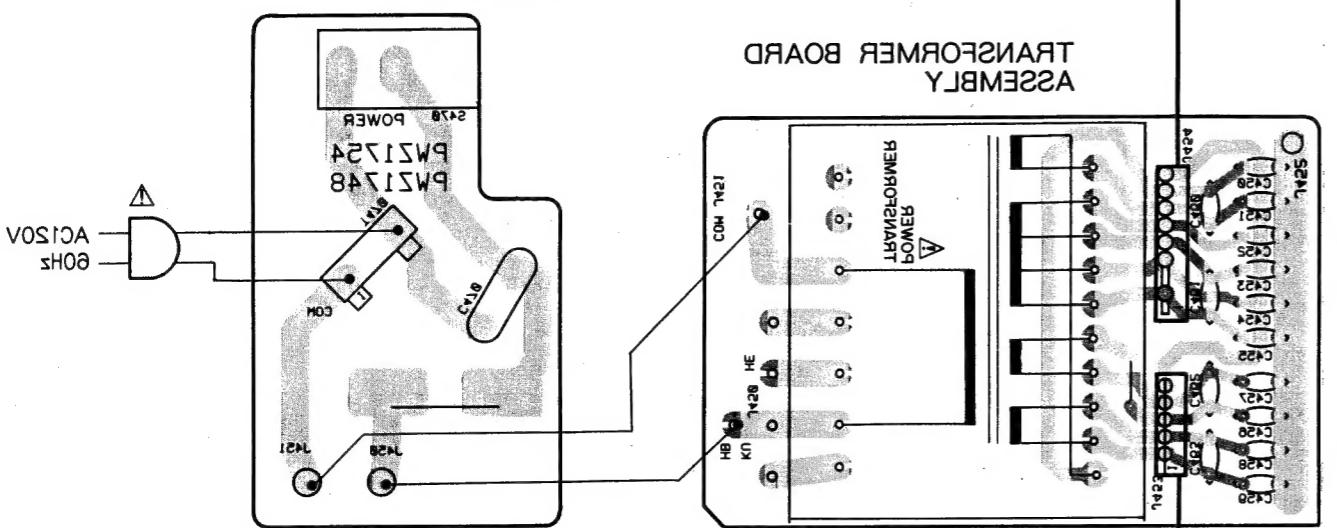
*4 IC350 (PD3165A)				*5 IC601 (PDG036)			
Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts
1	0	33	5	1	0.5 - 0.6	33	- 0.7 - -
2	1.7	34	5	2	0	34	4.9
3	2.1	35	0	3	5	35	2 - 2.1
4	5	36	5	4	4.9	36	- 0.7 - -
5	5	37	5	5	0	37	- 0.7 - -
6	5	38	5	6	0	38	- 0.7 - -
7	5	39	0	7	0.4 - 0.6	39	- 18.5 - -
8	5	40	0	8	0	40	- 15.4
9	5	41	0.1	9	0	41	5
10	5	42	0	10	5	42	- 6.7
11	4.6	43	0	11	5	43	5
12	0	44	0	12	0	44	- 12.2
13	0	45	0	13	0	45	- 0.8
14	5	46	0	14	0	46	- 24.5
15	3.6 - 3.8	47	0	15	0	47	- 21.3
16	4.7 - 4.8	48	4.9	16	5	48	- 21.5
17	4.7	49	0	17	5	49	- 21.5
18	4.6 - 4.7	50	5	18	5	50	- 21.5
19	4.6 - 4.7	51	0	19	5	51	- 21.5
20	4.3 - 4.4	52	0	20	5	52	- 21.5
21	5	53	0	21	5	53	- 21.5
22	0	54	0	22	5	54	- 21.5
23	5	55	0	23	NC	55	- 21.3
24	5	56	0	24	0	56	- 21.3
25	4.9	57	0	25	0	57	- 24.6
26	0	58	0	26	0	58	0
27	0	59	0	27	0	59	0
28	0	60	0	28	5	60	2
29	0	61	0	29	0	61	2.4
30	5	62	0	30	0	62	5
31	0	63	0	31	5	63	5
32	0	64	2.5	32	0	64	5

IC730, 731 (PCM63P)				IC710 (SM5813AP)			
Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts
1	-1.3	15	0	1	2.5	15	5
2	5	16	0	2	0	16	0
3	3	17	0	3	5	17	5
4	2	18	1.9	4	0	18	0
5	0	19	0	5	0	19	0
6	0	20	3.7	6	2.5	20	2.5
7	0	21	1.9	7	2.5	21	0
8	0	22	0	8	0	22	5
9	0	23	-3.7	9	1.9	23	2
10	0	24	-3.7	10	5	24	1.9
11	-5	25	-3.2	11	0	25	3.8
12	0	26	0	12	0	26	2
13	5	27	0	13	0	27	2.5
14	0	28	-5	14	4.9	28	14

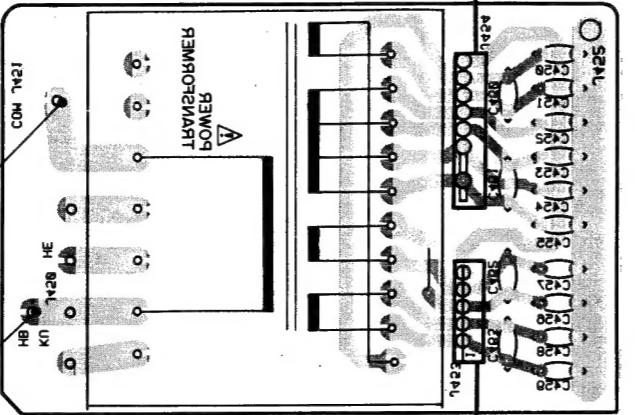
JARD ASSEMBLY (PWX1133 : KU/CA, HPW TYPES)  
(PWX1132 : HEM, HB, SD TYPES)



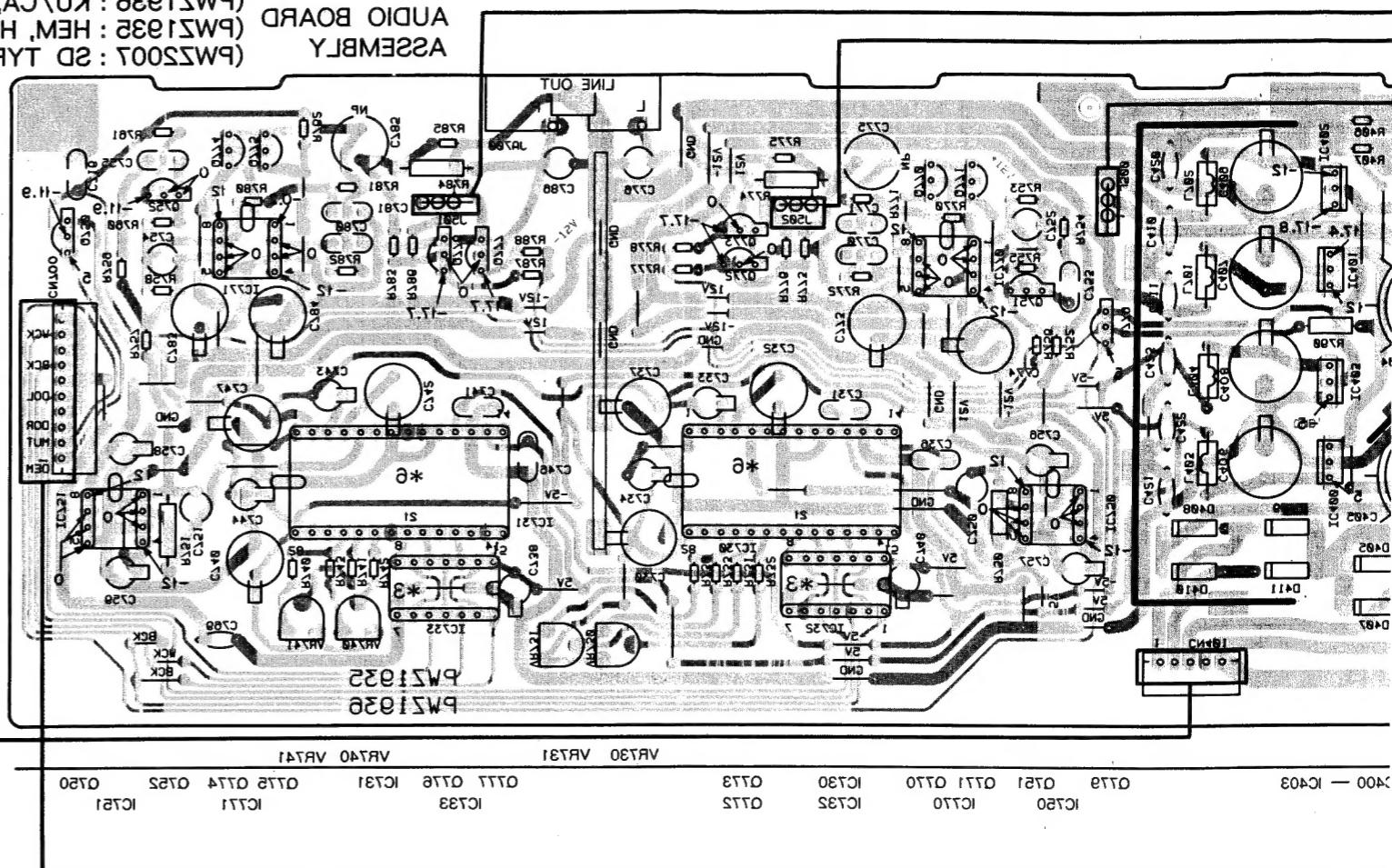
PRIMARY BOARD  
ASSEMBLY



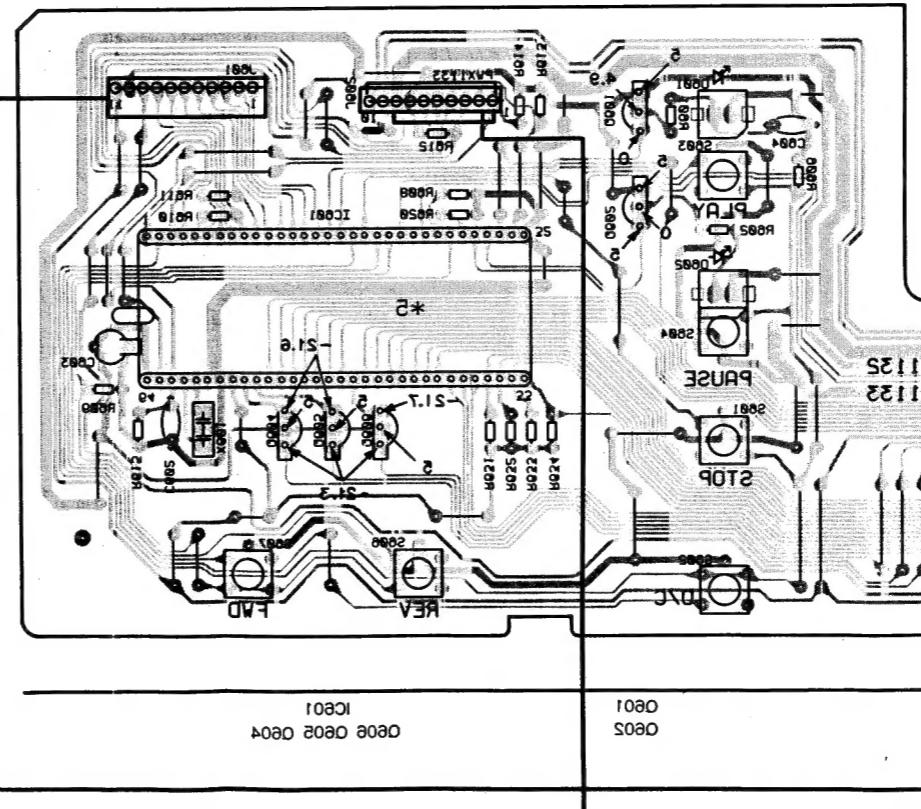
## TRANS ASSEM



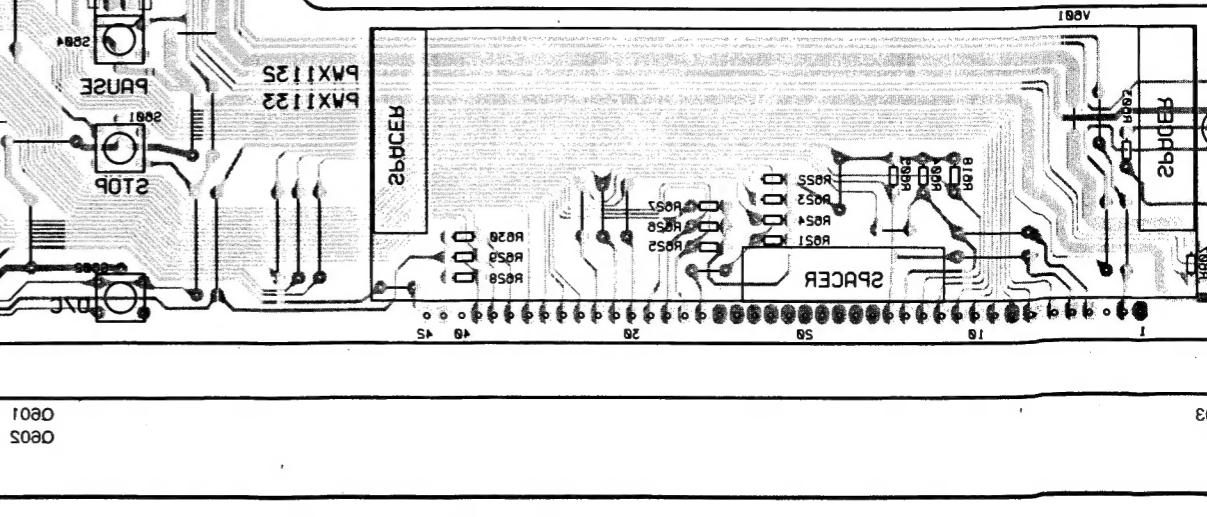
ASSEMBLY (PWZ5001 : SD TYPE) AUDIO BOARD (PWZ1835 : HEM, HB TYPES) (PWZ1836 : KU\CA, HPM TYPES)



(PWX1133 : KU\CA, HPM TYPES)



Geode G605 G604



COL10 (SMGB1A/BP)		COL10, TAI (PCMB6B)	
Volts	mA	Volts	mA
1	25	1	15
2	15	2	5
3	0	3	0
4	15	4	0
5	0	5	0
6	18	6	0
7	0	7	0
8	25	8	0
9	0	9	0
10	25	10	0
11	0	11	0
12	0	12	0
13	0	13	0
14	25	14	0
15	0	15	0
16	25	16	0
17	0	17	0
18	25	18	0
19	0	19	0
20	25	20	0
21	0	21	0
22	25	22	0
23	0	23	0
24	25	24	0
25	0	25	0

## PCBOARDS CONNECTION DIAGRAM

